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The role of class-level composition and schools´ contextual characteristics for school-aged children´s life satisfaction: a three-level multilevel analysis

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Aim of this study is to examine the role of individual, class-level composition and school-level contextual features on school-aged children´s life satisfaction. Methods: Data from students in ninth grade (n = 10,715), in 745 classes within 406 secondary schools of the German National Educational Panel Study (NEPS) were used. Bivariate and three-level logistic multilevel analyses were conducted including individual-level, class-level composition (school performance, school disengagement, ambition and academic effort, level of helplessness in major subjects), teacher assessments of class composition, and school-level features (funding, socio-economic status, school infrastructure). Results show, that at class-level, level of ambitious classmates was associated with higher life satisfaction. Students placed in classrooms with higher shares of classmates expecting academic effort revealed lower life satisfaction. Conclusions: Apart from contextual features, the composition of the overall learning environment in class is partially related to young people´s life satisfaction.

Introduction

Schools play a vital role in adolescents´ lives as young people spend the majority of their daily time in school. Schools are often considered as developmental systems, being composed of classroom environments and contextual aspects of the school (Eccles & Roeser, 2011). According to previous studies, the overall school environment is important for young people´s academic and non-academic development (Virtanen et al., 2009). In this context, schools have often been characterized as a ‘multi-layered phenomenon’ (Rumberger & Palardy, 2005) with students nested in classrooms, which are nested in schools. Several studies have suggested considering the importance of the hierarchical structure of data when analyzing the effect of school environment on students´ outcomes (Andersson et al., 2010; Sellström & Bremberg, 2006).

At the individual-level, previous studies revealed, for instance, that students who perceive a positive learning environment report better well-being (Virtanen et al., 2009). However, one problem with this and similar evidence is that the concepts and terms examined, such as ‘learning environment’ are often not well defined or are used interchangeably and tend to comprise a wide range of only loosely related factors, including respectful and supportive relationships, commitment to school, participation, or feelings of safety in school (Kidger, Araya, Donovan, & Gunnell,
Recent research has highlighted the psychosocial environment in schools, characterized by adequate and appropriate supervision, supportive relationships and support, as important determinants of positive youth development (Eccles & Roeser, 2011; Virtanen et al., 2009). In school settings, students’ perceptions of a positive psychosocial learning environment have been associated with positive developmental outcomes, such as good mental health, and with a lack of health risk behaviours (Inchley et al., 2016). For instance, students who perceive their learning environments as characterized by a lower level of competition among classmates were positively related to well-being (Modin, Östberg, Toivanen, & Sundell, 2011), whereas disengagement from school and perceived school pressure were associated with poorer well-being and life satisfaction among students (Inchley et al., 2016; Torsheim, Aaroe, & Wold, 2003). Further, previous studies demonstrate that the perception of the learning environment has not only short-term, but also long-term effects on students’ well-being, school results and even their employment rates after the educational career (Allodi, 2010).

However, there has been a growing interest in unravelling the impact of the multilevel environment of schools on student outcomes, taking into account also compositional and contextual characteristics of school classes and schools which allow developing ‘whole-school’ approaches (Allodi, 2010; Kidger et al., 2012; Sellström & Bremberg, 2006). In line with this arguing, it is important to distinguish between so-called compositional and contextual features of classes and schools in order to explain differences in student outcomes not only by individual characteristics but also by class- and school-level characteristics (Eccles & Roeser, 2011; Kidger et al., 2012). Compositional features refer to the intake of student characteristics in classes and schools, often measured at the individual student-level, by aggregating information from students to the class- or school-level (e.g. such as the mean- or average-levels of the psychosocial learning environment or proportion of students with specific background characteristics). In contrast, contextual factors focus, for instance, on the shared organizational, cultural, social, and physical factors within the schools and school classes, often surveyed by teachers and school principals (Andersson et al., 2010; Kidger et al., 2012; Modin & Östberg, 2009).

With regard to compositional characteristics in school classes, students share most of their school time in classrooms with classmates who have different personal traits, social backgrounds as well as attitudes towards schoolwork and learning. Thus, classrooms constitute the most important psychosocial environment of educational settings for young people in terms of learning environment, cooperation between students, teacher–student relationships, competition, student participation and engagement towards schoolwork (Allodi, 2010; Eccles & Roeser, 2011; Harker & Tymms, 2004). Studies have found evidence that the overall positive peer and teacher relationships in class, a psychosocial learning environment judged favourably on aspects such as safety and fairness, and feelings of school ‘connectedness’ or ‘bonding’ are all associated with better well-being indicators, such as emotional health. However, research has often used different outcomes or characteristics of class composition (Kidger et al., 2012; Sellström & Bremberg, 2006), which makes it difficult to draw a conclusive summary of the state-of-the-art in relation to compositional features in classes on students’ overall well-being.

At the class- and school-level, few studies have considered contextual features of schools on students’ life satisfaction. Contextual features are mainly related to the physical environment and structural characteristics of schools, such as the size of schools, the school neighbourhood (poor or rich), the infrastructure of the school, or whether it is a private or public funded school (see Bonell et al., 2013; Kidger et al., 2012 for a review). So far, prior studies on the impact of compositional and contextual features on students’ well-being – using different indicators of well-being – have often used two-level multilevel modeling, showing that beyond the individual student-level, features of classrooms or schools did also have an impact on student outcomes, even though to a smaller degree (Sellström & Bremberg, 2006). Previous studies showed, for instance, that the gender ratio in schools have been related to student outcomes, indicating that school classes with a higher proportion of girls performed academically better, had more positive disciplinary standards and
attitudes, but classes with a higher share of girls were not related to student mental health (Andersson et al., 2010). Further, the share of students with migration background or poorer socio-economic background in schools or classes (e.g. Benner & Crosnoe, 2011; Crosnoe, 2009) has been investigated in manifold studies for academic performance, in some studies on young people’s psychosomatic or emotional health (Kidger et al., 2012; Modin & Östberg, 2009), but not for students’ life satisfaction. Studies using three-level multilevel models, taking compositional and contextual features at the class- and school-level into account, are scarce as surveys often lack information on different levels, such as the assessment of the (physical) school context, reported by teachers or school principals. For instance, a study from Sweden showed that contextual conditions at school-level, such as the proportion of students with a foreign background, were associated with poorer psychosomatic health, while the proportion of girls, mean marks and parents overall level of education at school-level are not significantly related to students’ psychosomatic health (Modin & Östberg, 2009). A review on the impact of the school environment on students’ emotional well-being therefore concluded that a supportive school environment can partially improve students’ emotional well-being, whereas school-level contextual factors had less impact (Kidger et al., 2012).

In general, studies using subjective measures from students as an outcome revealed less variance between classes or schools (Belfì, Goos, Fraine, & van Damme, 2012; Kidger et al., 2012; Nygren, Bergström, Janlert, & Nygren, 2014; Saab & Klinger, 2010) than studies on health-related behaviours (Sellström & Bremberg, 2006).

So far, not much is known about whether the class composition and school context are related to students’ life satisfaction. Life satisfaction as a measure of subjective well-being is of crucial importance to young people’s psychological, educational, social and physical functioning (Suldo et al., 2009). In contrast to emotions, life satisfaction is considered to be a relatively stable indicator of subjective well-being (Diener & Lucas, 1999; Suldo et al., 2009). From a methodological point of view, so far, it has not been possible to examine the impact of the class composition and contextual features of schools on students’ life satisfaction in Germany due to the lack of survey data containing information from students, class teachers and school principals. Thus, this study examines the role of class-level as well as school contextual features, reported by teachers and school principals in order to assess their importance for students’ life satisfaction. Our study focuses on the following research questions:

1. What role does composition at class-level and school-level contextual characteristics play for students’ life satisfaction above and beyond individual-level student characteristics?
2. To what extent can the variance in students’ life satisfaction be explained by individual-, class- and school-level features?

**Methods**

**Data**

The National Educational Panel Study (NEPS) carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg (Blossfeld, Maurice, & Bayer, 2016; Blossfeld, Roßbach, & Maurice, 2011). It examines educational processes in Germany across the entire lifespan following six separate cohorts (SC) from 2010 to 2025. For our study, we utilized data from the first wave of the fourth starting cohort, surveying students in grade 9, usually aged 14 to 15 years in regular schools in Germany. The students were sampled through a stratified multi-stage process. After stratification by school type, region and other characteristics first schools were drawn and from those and then full classes were sampled (Aßmann et al., 2011; Skopek, Pink, & Bela, 2012). Students were interviewed in class by interviewers using paper and pencil interviews (PAPI). The survey documents used were previously submitted to, and reviewed and approved by the respective Ministries of Education of the 16 federal states. During the survey, NEPS worked closely with the relevant data protection officers of the federal states for strict compliance with the statutory data protection regulations.
Indicators

Outcome: life satisfaction
General life satisfaction was used as an indicator of students’ well-being. Life satisfaction was measured by asking students how satisfied they are with their life (0 = “not at all” – 10 = ‘very satisfied’) (Cantril, 1965). This measure has been validated in several studies (Inchley et al., 2016; Ravens-Sieberer et al., 2009) and was used as a metric measure in our analyses.

Independent variables
A list of the indicators used to operationalize the independent variables can be found in Table 1.

To avoid overestimation of the importance of school contextual features and compositional school class characteristics due to their selective entry, relevant variables at the student-level must be included in the analyses. Thus, the demonstration of a school effect or a school class effect depends on the extent to which studies are able to control for the characteristics of individuals making up the school and class intakes (Andersson et al., 2010). NEPS provides all these necessary information at the individual student-level, class-level and school-level. In order to measure the learning environment in school classes, students’ individual assessment of the perceived learning environment in class has been aggregated to the class-level in order to use the individual items as compositional measures (Hox, 2010). For each of the learning environment indicators, a mean score for each class was created and was centred on their grand mean (Hox, 2010). In research on compositional analyses, it is a necessary precondition to include not only the class-level aggregates but also to adjust for the individual measures (Hox, 2010; Rumberger & Palardy, 2005). All indicators have been z-standardized in order to compare coefficients of each compositional indicator in relation to their impact on students’ life satisfaction. Table 1 presents all indicators at the individual-, class- and school-level.

This study controls for students’ gender and age as previous studies showed that life satisfaction varies significantly among those background variables. We also adjusted for school type as the educational system in Germany is highly differentiated and hierarchically organized in terms of different low (‘Hauptschule’), medium (‘Realschule’) and high track schools (‘Gymnasium’) as well as mixed track or comprehensive schools (‘Gesamtschule’) combining aspects of all tracks, as compositional and contextual school characteristics significantly differ among different school types.

Sample
We analyzed data from the students questionnaires at the individual level (n = 10,715 students), compositional data derived from data of students in the same class at the class level (n = 745 classes with an average class size of 24 students, of which on average 14 students were interviewed), data from the teachers’ questionnaires at the class level as well, and data from the schools’ principals questionnaires at the school level (n = 406 schools). School classes with less than 10 students per class were excluded from the analyses.

Analyses
The study utilizes multilevel analyses to model the hierarchical data structure of students nested in classes nested in school. To account for differences within and between classes and schools we computed random intercept models (Hox, 2010). A stepwise approach was used to construct nested models. First, an empty model (Model 0) tested the Intraclass Correlation Coefficients (ICC) to determine variance between classes and schools. Model 1 includes the indicators for the perceived learning environment at the individual level. Model 2 includes the aggregates of these indicators at class-level. Model 3 adds indicators of contextual characteristics at class-level. Finally, Model 4 includes indicators as the school-level.
Table 1. List of indicators.

| Variables                          | Item(s)                                                                 | Operationalization                                                                 | Cronbach's alpha |
|-----------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------|
| **Class-level indicators of composition in class** | To what extent do the following statements apply to you? (Schwarzer & Jerusalem, 1999) | 1 = doesn’t apply at all… 4 = completely applies Range: 1–4 | 0.86             |
| Helplessness in Math              | ● No matter whether or not I do my best in mathematics, it will not improve my grades  
                                       ● It is not worth practicing mathematics for a test because I will come off badly again anyway  
                                       ● I have accomplished almost nothing in mathematics of what I intended to do.  
                                       ● When our teacher asks me to answer a question in mathematics unexpectedly, I cannot even answer the simplest questions.  
                                       ● It is useless to make any effort to do my homework in mathematics as I will always make many mistakes. | 1 = very good… 6 = unsatisfactory Range: 0–6 | -                |
| Grade in Math                     | What grade did you have on the last mid-year report card in mathematics? | 1 = does not apply… 5 = applies completely Range: 1–5 | -                |
| Ambition of classmates            | Most of my classmates are very ambitious at school. | 1 = does not apply… 5 = applies completely Range: 1–5 | -                |
| Expected effort by classmates     | Most classmates expect classmates to make an effort at school. | 1 = does not apply… 5 = applies completely Range: 1–5 | -                |
| School disengagement              | Most classmates don’t care how well classmates do at school.            | 1 = does not apply… 5 = applies completely Range: 1–5 | -                |
| **Class-level indicators**        | Number of students in class. Number of students in class. Number of students | Number of students Range: 3–38 | -                |
| Percentage of girls               | Percentage of girls in class                                             | Percentage of students Range: 0–100% | -                |
| Percentage of students with migration background | How many students in your class have an immigration background, i.e. they or at least one parent were born abroad? | Percentage of students Range: 0–100% | -                |
| Perceived performance characteristics | How would you assess the class overall with regard to the following aspects? | 1 = Disinterested… 5 = interested Range: 6–30 | 0.81             |
| ● Interest                        | ● Discipline  
                                       ● Homogeneity (in terms of performance)  
                                       ● Student autonomy  
                                       ● Concentration  
                                       ● Focus on Performance | 0 = not partially or fully mandatory all-day school 1 = Partially or fully mandatory all-day school Range: 0–1 | -                |
| Full-day school                   | Is your school…                                                           | 0 = not partially or fully mandatory all-day school 1 = Partially or fully mandatory all-day school Range: 0–1 | -                |
| School funding                    | What is your school’s sponsoring agency? Is it a…                         | 0 = public sponsoring 1 = private sponsoring Range: 0–1 | -                |

(Continued)
Multiple imputations were applied to minimize bias which would be introduced by the common method of listwise deletion, particularly when considering the skewed distribution of cases with missing information over students’ school types. We imputed 50 data sets using multiple imputations by chained equations. For each level of the data, separate imputation models were used, each containing all variables of that level used in the analysis and the school type, before items were combined into scales or dichotomized or aggregated. The imputation models used logistic methods for dichotomous and categorical variables and predictive mean matching (PMM) to impute ordinal or metric variables, with the latter method also being able to handle non-linear associations (van Buuren, 2012). We conducted sensitivity analyses examining indicators for psychosocial learning environment in separate models and in combined constructs, as well as employing complete cases analyses to assess possible bias.

**Results**

**Descriptive results**

The mean age of students was 14.7 years (standard deviation of 0.72) and 49.7% were female. Of the students 35.2% visited a high track school, 21.4% a medium track school, 24.6% a low track school and 18.9% a mixed track or comprehensive school. The distribution of indicators at the individual-, class- and school-level is shown in Table 2. An investigation of correlations between indicators at the individual-, class- and school-level is presented in Table 3. Small associations show that lower helplessness in mathematics and better grades in mathematics are associated with higher life satisfaction at individual-level. The associations of aggregated helplessness and grades in mathematics with individual life satisfaction are weaker. At individual-level, higher ambition, higher school effort, and lower school disengagement of classmates are weakly associated with higher life satisfaction, which is also found for aggregated class-level ambition and disengagement. All other associations are smaller and almost negligible.

We further checked for possible issues of multicollinearity, especially when considering some indicators at class-level are aggregates of indicators at individual level. Helplessness in mathematics is strongly correlated with grade in mathematics at both individual- and class-level. At individual-level, higher helplessness in mathematics is not correlated with any other indicator at individual-level, but at class-level, higher helplessness in mathematics is associated with higher school disengagement and lower ambition of classmates, and vice versa for grade in mathematics. At individual- and class-level, higher ambition of classmates is moderately associated with higher expectations of classmates towards academic effort, and both are moderately associated with lower school disengagement. Larger classes tend to have a higher percentage of girls and a lower percentage of students with migration background. Also, full-time schools and privately

| Variables | Item(s)                                                                 | Operationalization               | Cronbach's alpha |
|-----------|-------------------------------------------------------------------------|----------------------------------|------------------|
| Percentage of students with low SES background | What is the percentage of students at your school coming from families from… | Range: 0–100%               |                  |
|           | • Rather lower social classes?                                           |                                  |                  |
|           | • Rather middle social classes?                                          |                                  |                  |
|           | • Rather higher social classes?                                          |                                  |                  |
| School infrastructure | How do you rate the quality and/or condition of the school building and/or school buildings in terms of the following aspects? | 1 = poor… 4 = good  Range: 4–16 | 0.82             |
|           | • Lighting                                                              |                                  |                  |
|           | • Size                                                                  |                                  |                  |
|           | • Functionality                                                         |                                  |                  |
|           | • Structural condition                                                  |                                  |                  |

𝑐 = these indicators at the individual-level have been aggregated to the class-level in order to measure the perceived learning environment of students; 𝑡 = information from teacher assessments; 𝑠𝑝 = information from school principals.

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Table 2. Distribution of indicators at the individual-, class- and school-level.

| Dependent variable                  | Mean | SD   | Min.–Max. | Cronbach's alpha |
|-------------------------------------|------|------|-----------|------------------|
| Life satisfaction                   | 7.49 | 2.04 | 0–10      | -                |
| **Student-level indicators (N = 10,715)** |      |      |           |                  |
| Helplessness in Math               | 8.41 | 3.67 | 5–20      | 0.86             |
| Grade in Math                      | 2.98 | 1.02 | 1–6       | -                |
| Ambitious classmates               | 3.06 | 0.79 | 1–5       | -                |
| Classmates expectations about academic effort | 2.49 | 0.96 | 1–5       | -                |
| Classmates school disengagement    | 2.73 | 0.95 | 1–5       | -                |
| **Class-level composition indicators (N_{class} = 745)** |      |      |           |                  |
| Helplessness in Math               | 8.42 | 1.21 | 5–20      | -                |
| Average grade in Math              | 2.98 | 0.39 | 1.5–5     | -                |
| Ambitious classmates               | 3.06 | 0.34 | 1–5       | -                |
| Classmates expectations about academic effort | 2.49 | 0.31 | 1–5       | -                |
| Classmates school disengagement    | 2.73 | 0.33 | 1–5       | -                |
| **Class-level indicators** |      |      |           |                  |
| Number of students in class        | 23.88| 5.52 | 3–38      | -                |
| Percentage of girls                | 47.85| 13.99| 0–100     | -                |
| Percentage of students with migration background | 21.21| 21.67| 0–100     | -                |
| Perceived performance characteristics | 20.74| 3.65 | 8–30      | 0.81             |
| **School-level indicators** (N_{school} = 406) |      |      |           |                  |
| Full-time school                   | 11.9%| -    | 0–1       | -                |
| Funding: private                   | 9.2% | -    | 0–1       | -                |
| Percentage of students with low SES background | 30.48| 24.44| 0–100     | -                |
| School infrastructure              | 12.44| 2.55 | 4–16      | 0.82             |

SD = Standard Deviation; c = indicators at the individual-level have been aggregated to the class-level in order to measure the perceived learning environment of students; t = information from teacher assessments; sp = information from school principals.

Table 3. Pairwise correlations between indicators at the individual-, class- and school-level.

| Perceived learning environment (individual-level) (1) (2) (3) (4) | Life satisfaction (individual-level) |
|-----------------------------------------------------------------|--------------------------------------|
| Helplessness in Math                                           | 1                                    |
| Grade in Math                                                   | 0.403***                            |
| Ambitious classmates                                           | -0.021*                             |
| Classmates expectations about academic effort                   | -0.010                              |
| Classmates school disengagement                                 | -0.001                              |
| Learning environment in class (class-level)                     | 1                                    |
| Helplessness in Math                                           | 0.394***                            |
| Ambitious classmates                                           | -0.250***                           |
| Classmates expectations about academic effort                   | -0.017                             |
| Classmates school disengagement                                 | 0.127***                            |
| Teachers report on class composition (class-level)              | 1                                    |
| Number of students in class                                     | 0.218***                            |
| Percentage of girls                                            | -0.188***                           |
| School principals report on school context (school-level)       | 0.001                               |
| Full-time school                                                | 1                                    |
| Funding: private                                                | 0.177***                            |
| Percentage of students with low SES background                  | 0.001                               |

*p < .05; **p < .01; ***significant at p < .001; c = indicators at the individual-level have been aggregated to the class-level in order to measure the perceived learning environment of students; t = information from teacher assessments; sp = information from school principals.
funded schools have a lower percentage of students with low SES background. Other correlations are smaller or even negligible.

**Multivariate multilevel results**

Results from the linear hierarchical models are presented in Table 4. According to the empty model, life satisfaction varies to a higher extent among classes (ICC\textsubscript{classes}: 1.0%) compared to schools (ICC\textsubscript{schools}: 0.8%). After introducing individual indicators of students’ perception of the learning environment to model 2, students who report higher helplessness in mathematics (b = −0.213), lower grades in mathematics (b = −0.098) as well as perceiving disengagement of classmates (b = −0.068) show lower life satisfaction. In contrast, students who perceive their classmates to be ambitious (b = 0.110) and classmates who expect effort from others (b = 0.065) showed higher life satisfaction.

Model 3 includes the aggregated class-level compositional indicators of psychosocial learning environment. As in model 2, all individual-level measures were still significantly related to students’ life satisfaction. For the aggregated compositional measures it was found that students placed in classes with a higher share of ambitious classmates (b = 0.262) showed higher life satisfaction (model 3), whereas students attending classes with a higher level of classmates who expect effort from others were less satisfied with their lives (b = −0.158). Classes with a higher level of students reporting helplessness in mathematics, with on average lower grades in mathematics and a higher extent of disengaged classmates were not significantly associated with students’ life satisfaction. In contrast, associations between class size, percentage of girls and share of students with migration background in class as well as teachers’ assessment of students’ performance characteristics were not significantly associated with students’ life satisfaction (model 4).

In the full model (model 5) we also considered contextual school characteristics. The results indicate that students’ life satisfaction does not significantly differ according to schools’ profile (i.e. full time or part time), schools funding as well as schools socio-economic standing. In contrast, students in schools with a higher level of infrastructural quality showed higher life satisfaction (b = 0.048). Associations at the student- and class-level from models 1–4 remained still significantly related to students’ life satisfaction. In relation to research question 2, the final model reveals that ICCs were reduced to 0.8% at the class-level and to 0.5% at the school-level, suggesting that variation in life satisfaction is mostly explained by individual-level variables, but also – to a much smaller extent – by class-level characteristics and particularly by the quality of psychosocial learning environment.

**Discussion**

**Summary of results**

The aim of the present study was to investigate the role of individual, class-level compositional and school contextual characteristics on students’ life satisfaction. At the individual-level, females and older students showed lower life satisfaction, as well as students who feel more helpless in Mathematics, report lower grades in Mathematics, and who perceive their classmates to be disengaged from school. In contrast, perceiving classmates to be ambitious and having classmates who expect academic effort were related to higher life satisfaction.

Regarding compositional measures at class-level, students placed in classes with a higher extent of classmates who are perceived as ambitious revealed lower life satisfaction. In contrast, lower life satisfaction was found for students in classes with a higher level of classmates who are perceived as disengaged from school. However, teachers’ assessments of class composition in terms of class size, proportion of female students and students with migration background as well as perceived student performance were not related to life satisfaction. Lastly, in contrast to prior studies on the impact of school-level features on student well-being, contextual features of schools were – with one exception – not associated with life satisfaction (Saab & Klinger, 2010; Sellström & Bremberg, 2006). Only
Table 4. Parameter estimates for life satisfaction as a function of indicators at the individual-, class- and school-level.

|                     | Model 0: Empty model | Model 1: Controls + student-level indicators | Model 2: M1 + class-level composition indicators | Model 3: M2 + class-level indicators | Model 4: final model |
|---------------------|----------------------|---------------------------------------------|------------------------------------------------|-------------------------------------|----------------------|
|                     | \( \beta \) (SE)     | \( \beta \) (SE)                            | \( \beta \) (SE)                                | \( \beta \) (SE)                    | \( \beta \) (SE)              |
| **Perceived learning environment (individual-level)** |                      |                                             |                                               |                                     |                      |
| Helplessness in Mathematics | -.209 (.024)***      | -.216 (.025)***                             | -.217 (.025)***                              | -.217 (.025)***                   |                      |
| Grade in Mathematics   | -.107 (.023)***      | -.110 (.025)***                             | -.110 (.025)***                              | -.110 (.025)***                   |                      |
| Ambitious classmates  | .112 (.023)***       | .096 (.025)***                              | .096 (.025)***                               | .096 (.025)***                    |                      |
| Classmates expectations about academic effort | .076 (.021)***       | .085 (.022)***                              | .085 (.022)***                              | .085 (.022)***                    |                      |
| Classmates school disengagement | -.048 (.021)*      | -.047 (.022)*                               | -.047 (.022)*                                | -.047 (.022)*                     |                      |
| **Perceived learning environment (at class-level)** |                      |                                             |                                               |                                     |                      |
| Helplessness in Mathematics |                        | .027 (.021)                                | .029 (.021)                                  | .032 (.021)                       |                      |
| Grade in Mathematics   |                        | .080 (.069)                                 | .066 (.070)                                  | .029 (.071)                       |                      |
| Ambitious classmates  |                        | .251 (.098)**                              | .262 (.099)**                                | .271 (.098)**                     |                      |
| Classmates expectations about academic effort |                        | -.144 (.083)+                              | -.156 (.084)+                                | -.176 (.083)*                     |                      |
| Classmates school disengagement |                        | .014 (.086)                                | .014 (.086)                                  | .016 (.086)                       |                      |
| **Compositional characteristics (class-level)** |                      |                                             |                                               |                                     |                      |
| Number of students in class |                        |                                             | .048 (.032)                                  | .046 (.031)                       |                      |
| % of girls            |                        |                                             | -.021 (.025)                                 | -.019 (.025)                      |                      |
| % of students with migration background |                        |                                             | .039 (.027)                                  | .026 (.027)                       |                      |
| Students’ performance characteristics |                        |                                             | .011 (.028)                                  | .012 (.029)                       |                      |
| **School-level indicators** |                      |                                             |                                               |                                     |                      |
| Full-time school      |                        |                                             |                                               | .020 (.021)                       |                      |
| Funding: private      |                        |                                             |                                               | -.092 (.083)                      |                      |
| % students with low SES |                        |                                             |                                               | .042 (.034)                       |                      |
| School infrastructure |                        |                                             |                                               | .048 (.023)*                      |                      |
| Intercept             | 7.487 (.024)***       | 7.712 (.046)***                             | 6.777 (.542)**                                | 6.775 (.541)**                    | 6.941 (.551)**         |
| Variance between schools | .033                  | .023                                      | .023                                        | .021                              | .019                  |
| Variance between classes | .043                  | .036                                      | .033                                        | .035                              | .032                  |
| Variance between students | 4.094                 | 4.937                                      | 3.938                                        | 3.937                             | 3.938                 |
| ICC_{schools}         | 0.008 = 0.8%          | 0.005 = 0.05%                              | 0.006 = 0.06%                                | 0.005 = 0.05%                     | 0.005 = 0.05%          |
| ICC_{classes}         | 0.010 = 1.0%          | 0.007 = 0.7%                               | 0.008 = 0.8%                                | 0.009 = 0.9%                      | 0.008 = 0.8%           |
| N_{schools}           | 406                   | 406                                        | 406                                          | 406                               | 406                   |
| N_{classes}           | 745                   | 745                                        | 745                                          | 745                               | 745                   |
| N_{students}          | 10,715                | 10,715                                     | 10,715                                       | 10,715                            | 10,715                |
| Deviance (−2 LL)      | 62,085.24 (df = 4)    | 61,532.84 (df = 14)                        | 61,532.84 (df = 19)                          | 61,602.52 (df = 23)               | 45,318.00 (df = 27)   |

+ p < .10; *p < .05; **p < .01; ***p < .001. M1-M4: under control of gender, age (centred) and attended school type. All class- and school-level indicators were z-standardized. RC = Reference category: boys, high school track (Gymnasium) and public funding; c = indicators at the individual-level have been aggregated to the class-level in order to measure the perceived learning environment in class; aggr = individual student assessments were aggregated to the class-level (average-level in class); tq = information from teacher questionnaires; sp = information from school principals.
schools’ infrastructure was related to students’ life satisfaction, showing that students in schools with better infrastructural quality showed a lower life satisfaction, a finding that is surprising.

**Discussion of results**

Our results show that besides individual-level indicators, compositional and contextual characteristics in classes have a much lower impact on students’ life satisfaction. At the individual-level, students who reported to be helpless in Mathematics and with poorer grades in Mathematics were associated with lower life satisfaction. It is likely that students with low school performance and who feel helpless face pressure from teachers or from better performing classmates in order to keep up with them, highlighting that the learning environment is a commonly reported source of distress among young people (Modin et al., 2011; Torsheim et al., 2003). In line with other studies, feelings of pressure at school are associated with lower life satisfaction (Inchley et al., 2016; Torsheim et al., 2003). In contrast, students who perceived classmates as ambitious and reported that classmates expect academic effort revealed higher life satisfaction. These associations may be explained by the positive attitude of students towards school, which is also likely to represent the level of students’ school engagement. Some studies have shown that young people’s engagement and interest in school work is beneficial for students’ well-being (Inchley et al., 2016). However, it is also plausible that perceiving classmates as ambitious and expecting academic effort would be detrimental for students’ life satisfaction as young people are likely to feel pressured by classmates. However, further research is warranted in order to unravel these associations with life satisfaction.

Our results also show that students who are placed in classes with higher levels of ambitious classmates revealed higher life satisfaction, whereas students in classes with a higher level of classmates who expect to show academic effort from other classmates showed lower life satisfaction. As previous studies used other indicators of the psychosocial learning environment in class, it is hardly possible to compare our findings with those results. Thus, it is only possible to speculate about potential mechanisms. Being surrounded by a higher share of classmates who are ambitious may indicate a psychosocial learning environment in class, which is being characterized by a positive value and engagement towards school that is shared by the majority of students in class. Therefore, it is likely that students feel better in those classrooms, resulting in better reports of life satisfaction. On the other hand, being placed in classroom with a high level of ambitious peers could also be likely to result in comparisons with the reference group, being associated with a negative impact on life satisfaction. However, due to the cross-sectional design of our study, it is not possible to validate these associations. Further, our results revealed that students placed in classes with an above-average extent of students who expect academic effort from other classmates reported lower life satisfaction. This finding is clearly linked to the feeling of being pressured by peers in class in order to keep academic effort as high as possible. In contrast to the finding at the individual-level, the class-level indicator of perceiving classmates as expecting academic effort was negatively associated with life satisfaction. This finding is quite plausible as the share of students with those characteristics increases, the learning environment is likely to be affected by an ambitious and maybe higher competitive climate among peers. In line with the Stage-Environment-Fit-Model (Eccles & Roeser, 2011), classmates who require effort from other peers are likely to put pressure on those students, which challenges students’ psychological needs for competence and relatedness, which is likely to be negatively related to students’ overall life satisfaction.

At the school-level, only a higher level of school infrastructure (e.g. better lighting, size of school building) was related to lower life satisfaction, a finding which is quite surprising at first glance. It is likely that schools, where school principals report that their schools have better infrastructure, put emphasis on the preservation and care about their school buildings, which in turn also likely to result in enforcing corresponding behaviour from students in those schools.
Strengths and limitations

NEPS provides a high number of cases representative for the German educational system and including data from students, teachers and school principals. This also leads to a rather high proportion of missing data, which can be handled using multiple imputation. Another important limitation is the cross-sectional nature of the analysis. Therefore, the findings are based only on assumptions on the directions of links between schools’ learning environments at different levels and life satisfaction, which cannot be tested empirically in cross-sectional studies. Lastly, as some independent indicators were strongly correlated, sensitivity analyses have been applied by running separate models, respectively, for helplessness in mathematics, grade in mathematics, perceived ambition, academic effort and school disengagement of classmates. However, size and direction of the coefficients were similar to those in the joint analyses.

Conclusion

The present study shows that individual characteristics explained most of the variation in life satisfaction, while the importance of composition in class and school-level features were less important the more distal they are from student lives. The results in particular showed that students being placed in classes with a higher level of students who expect academic effort from others reported lower life satisfaction, while students in classes with a higher share of students who report to be surrounded by ambitious classmates revealed higher life satisfaction. Thus, the results suggest school initiatives to emphasize not only students’ performances but also their overall well-being. However, future studies are required to unravel (long-term) consequences of class composition and school contextual features on students’ well-being.

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