This is the published version of a paper published in *Social Indicators Research*.

ORIGINAL RESEARCH

Determinants of Declining School Belonging 2000–2018: The Case of Sweden

Björn Högberg[1] · **Solveig Petersen[2]** · **Mattias Strandh[3]** · **Klara Johansson[2]**

Abstract

Students' sense of belonging at school has declined across the world in recent decades, and more so in Sweden than in almost any other high-income country. However, we do not know the characteristics or causes of these worldwide trends. Using data on Swedish students aged 15–16 years from the Programme for International Student Assessment (PISA) between 2000 and 2018, we show that the decline in school belonging in Sweden was driven by a disproportionately large decline at the bottom part of the distribution, and was greatest for foreign-born students, students from disadvantaged social backgrounds, and for low-achieving students. The decline cannot be accounted for by changes in student demographics or observable characteristics related to the school environment. The decline did, however, coincide with a major education reform, characterized by an increased use of summative evaluation, and an overall stronger performance-orientation.

Keywords School belonging · School connectedness · Adolescence · Temporal trends · School environment

1 Introduction

Children and adolescents spend a considerable amount of time in school, and schools are among their most important social and developmental contexts outside of the family (Eccles and Roeser 2011). Recently, the Programme for International Student Assessment (PISA) reported a "gradual declin[ing]" trend in students' sense of belonging at school across most participating countries (OECD 2017a, p 119). Studies of temporal trends in school belonging are, however, yet lacking, and we do not know the characteristics or extent of these trends, nor how they can be explained. Given the importance of school belonging for a range of positive outcomes, including academic achievement (Hodges et al. 2018; OECD 2017a; Slaten et al. 2016), cognitive and behavioral engagement in school

✉ Björn Högberg
   bjorn.hogberg@umu.se

1   Department of Social Work, and Centre for Demographic and Ageing Research (CEDAR), Umeå University, SE-901 87, Umeå, Sweden

2   Department of Epidemiology and Global Health, Umeå University, Umeå, Sweden

3   Department of Social Work, Umeå University, Umeå, Sweden

(Markowitz 2017a), and mental health and wellbeing (Joyce 2018; Kidger et al. 2012; Klinck et al. 2019; Markowitz 2017b), the current lack of knowledge regarding trends in school belonging is worrisome.

To the best of our knowledge, this is the first study to take a comprehensive view of temporal trends in students' school belonging, using data spanning over 18 years. We use individual-level survey data from the Swedish version of PISA, focusing on students aged 15–16 years. The Swedish case is instructive, insofar that the decline in school belonging has been greater in Sweden than in almost any other country participating in PISA. Swedish students reported among the very highest levels of belonging of all participating countries in the early surveys from 2000 and 2003, but then declined to average levels in 2015 and 2018 (OECD 2017a, 2019a). Moreover, the vast majority of existing studies on school belonging are from English-speaking countries (Allen et al. 2018; Kuang et al. 2019), while other cultural and educational contexts remain relatively unexplored. For these reasons, Sweden is an ideal case for an in-depth investigation into temporal trends in school belonging.

The study has a descriptive as well as an exploratory objective. First, we provide a detailed account of the characteristics of the decline in school belonging among Swedish students. Specifically, we analyse differences by gender, social and migration background, and levels of academic achievement, as well as differences across different parts of the distribution of school belonging, in other words, if there are signs of divergence or convergence between students with low versus high belonging. Second, we investigate the determinants of the decline, by analyzing a range of potential explanatory factors related to the learning and social environments in schools.

2 Background and Previous Research

2.1 The Concept of School Belonging

Various overlapping terms have been used to describe the attitudes and feelings of students towards school, including school connectedness, school engagement, school attachment, school involvement, sense of relatedness, and sense of school community (Libbey 2004). At the core of these terms is that they all aim to capture whether students feel accepted and included in the school environment, and as members of the school community (OECD 2017a). We use the term school belonging, in line with the conceptualization in PISA. School belonging is sometimes conceptualized as including observed behaviors in addition to thoughts and feelings (Hodges et al. 2018; Markowitz 2017a). In this study, we use a narrower definition, with a focus on the subjective feelings of students with regard to their situation in school, which is also consistent with how it is conceptualized in PISA (OECD 2017a).

2.2 Theoretical Framework

Research on school belonging has typically drawn on developmental theories from psychology to explain individual differences in belonging and related constructs, with stage-environment fit theory being one of the most prominent (Eccles and Midgley 1989). Stage-environment fit theory takes the needs of the individual adolescent as starting point, and focuses on how different environments support or undermine the fulfillment of those needs.

In the context of school belonging, the theory asserts that adolescents feel that they belong when the environment they face in school is appropriate given their developmental needs. Adolescence is a period of heightened self-focus, concerns over identity, and sensitivity to social comparison, and adolescents therefore need a noncomparative, noncompetitive environment that enables them to develop a stable identity. With the formation of a personal identity comes, moreover, a desire for autonomy, decision-making, and for opportunities to develop competences. The desire for autonomy, in turn, implies that supportive relationships with friends, but also with teachers and other non-family adults, become more salient.

Eccles and Midgley ([1989]) differentiate between three domains of the school environment—the organizational, the instructional, and the (social) climate—and describe how characteristics of these domains can be developmentally inappropriate for adolescents. (a) As regards the organizational domain, competitive motivational structures, ability grouping, tough grading standards, and a focus on (public) evaluation of students' work make social comparison and competition more salient, and leads to increased self-focus. (b) In the instructional domain, increased teacher control and fewer opportunities for decision-making leads to diminished autonomy and fewer opportunities to develop competences. (c) In the climate domain, bureaucratic and formal contacts undermine the formation of close bonds with teachers, while disrupted networks with peers (due to e.g. large schools or school transitions) undermine the continuity and stability of friendships. In sum, according to stage-environment fit theory, students are likely to perceive higher school belonging when schools offer a noncompetitive organizational and instructional environment (henceforth labeled *learning* environment) conducive to autonomous exploration, and a social climate (henceforth labeled *social* environment) conducive to forming supportive bonds with teachers and peers.

2.3 Previous Empirical Research on School Belonging

Much empirical research supports these broad propositions. As regards the social environment in school, research consistently shows that positive relationships with teachers, characterized by emotional and instructional support, are associated with higher school belonging (Allen et al. [2018]; Chiu et al. [2016]; Eccles and Roeser [2011]; Joyce [2018]). Supportive relationships with peers and parents are also positively, and bullying negatively, associated with school belonging (Allen et al. [2016], [2018]; Slaten et al. [2016]). Related to this, Chiu et al. ([2016]) show that school belonging is higher in more egalitarian compared to hierarchical cultures. This may be because hierarchical cultures value performance and competition over cooperation and mutual support, which work against the formation of supportive bonds (Chiu et al. [2016]).

As regards the learning environment, research shows that appropriately structured classrooms, in which disruptive behaviors are rare and in which students can concentrate on academic tasks, foster school belonging (Chiu et al. [2016]; Hodges et al. [2018]; Libbey [2004]; Ma [2003]; OECD [2017a]), possibly because such environments better enable students to develop their academic competences. However, harsh and unfair disciplinary policies restrict students' autonomy and can have the opposite effects on belonging (OECD [2017a]).

While to the best of our knowledge factors such as the degree to which learning environments are characterized by competition, performance orientation, and external evaluation have not been directly investigated in this context, indirect evidence suggests that such factors may undermine school belonging. For instance, in line with stage-environment fit

theory, students in performance-oriented learning environments, focused on the demonstration of performance, tend to put emphasis on the evaluation of the self, thus increasing social comparison and self-focus (Kumar 2006; Meece et al. 2006). In keeping with this, Cortina et al. (2017) show that Asian countries, focused on competitive testing and demonstration of relative ability, have lower school belonging. Research showing that performance-orientation is positively related with test anxiety (von der Embse et al. 2018), and that high-stakes testing has negative effects on school belonging (Markowitz 2018; Plank and Condliffe 2013), are also in line with theoretical predictions. Of particular relevance are findings showing that low academic achievement is associated with lower school belonging (Allen et al. 2016; Chiu et al. 2016). This indicates that students who fail to meet high demands may feel alienated by a focus on performance, and that low-achieving students may be particularly sensitive to social comparisons in relation to performance. Thus, while direct evidence is scarce, indirect evidence suggests that learning environments oriented towards competition, evaluation and performance provide a poor fit for the developmental needs of adolescents, and likely reduce school belonging (Eccles and Roeser 2011; Kumar 2006; Slaten et al. 2016).

In sum, there are theoretical and empirical reasons to expect that several environmental characteristics of schools can act as risk or protective factors in relation to school belonging. On the basis of frameworks for analyzing temporal trends in health outcomes (Högberg et al. 2020; Sweeting et al. 2010), changes in the prevalence of risk or protective factors can contribute to a change over time in an outcome, such as school belonging, by altering the extent to which students are exposed to them. The terms risk or protective factors reflect an origin in health research, where the outcome is typically conceptualized as undesirable (e.g. disease). In the context of school belonging, changes in exposure to a risk factor would be present if a factor with a *negative* effect on belonging, for instance disruptive behaviors in class, became more prevalent over time, in which case school belonging would decline, all else being equal. Likewise, changes in exposure to a protective factor would be present if a factor with a *positive* effect on belonging, such as support from teachers, became more prevalent over time, in which case school belonging would increase, all else being equal. Thus, attempts to explain trends in school belonging ought to take aim at how the prevalence of, or exposure to, risk and protective factors changes over time (henceforth the term exposure will be used to connote both risk and protective factors).

2.4 The Swedish Educational Context

Sweden is often regarded as a generous social democratic welfare state, with universal social policies, low levels of social inequality, and a comprehensive public education system in which students are not tracked until after compulsory school (at age 16). In terms of education policy, Sweden has since the 1990s moved from a centralized and public system to a decentralized system based on school choice, vouchers and competition, resulting in increased socio-economic segregation across schools (Holmlund et al. 2019).

Besides reforms of school governance, Sweden implemented a major reform of the school curriculum in 2011–2013. The reform, which coincides with the period studied here, aimed at strengthening the focus on goal-attainment through a standards-based curriculum, emphasis on instrumental values, stricter grading standards, and an increased use of assessments, including high-stakes national tests and course grades. In order to incentivize students to reach learning goals in compulsory school, it also introduced stricter achievement-criteria for access to upper secondary education. Overall, the reform marked

a shift from a more competence-oriented to a more performance-oriented learning environment, with an emphasis on summative evaluation and the demonstration of performance (Högberg et al. 2019; Lundahl et al. 2017; Sundberg and Wahlström 2015).

During the study period, Sweden moved from scoring above the OECD average academic achievement in the 2000 and 2003 PISA surveys, to below average in 2012, and then again above average in 2018. During the same time, the dispersion in academic achievement between students increased, mainly due to a decline for low-achieving students (Swedish National Agency for Education 2019).

3 Data and Methods

3.1 Data

Studies of temporal trends in subjective outcomes, such as school belonging, need to consider several issues related to the use of data and methodology (Collishaw 2015). First, the study participants should be representative of the population, and the sample frame be constant over time. Second, the non-response rates should be comparable over time, and third, the measures of the included variables should be equivalent over time. Individual-level survey data from the Swedish version of the Programme for International Student Assessment (PISA) largely satisfy these requirements. Most importantly, PISA data contain indicators of school belonging based on questions that have been asked in an identical way in five different survey waves: 2000, 2003, 2012, 2015 and 2018. PISA is to the best of our knowledge the longest representative time series available on school belonging, and therefore likely among the most suitable data available for trend analyses on the topic.

PISA is a repeated cross-sectional and school-based survey, managed by the OECD, with the aim to generate cross-country comparable data on the academic performance of 15-year-old students in high- and middle-income countries. The target population is all students between 15 years and 3 months and 16 years and 2 months at the beginning of the assessment period, who attend educational institutions in the country. Data are collected through a two-stage sampling design. In stage one, at least 150 schools are sampled with probabilities proportional to size from a list of all schools containing students in the relevant age range. In stage two, 35–42 students in this age range are selected with equal probability from the sampled schools (OECD 2017b, 2020).

Since we are interested in the temporal dimension, we use the maximum number of surveys for which data on school belonging are available: the years 2000, 2003, 2012, 2015 and 2018. The total sample size, with complete data on covariates, is 18,403. Non-response rates at the school-level fluctuate around one or two percent, and at the student-level around ten percent, with some increase between 2015 and 2018 (9.3% to 13.5%). Sample weights adjusting for non-response at both school and student levels are used throughout the analyses. It should be stressed that PISA is a repeated cross-sectional, not longitudinal, survey. Thus, temporal trends refer to differences over time between same-aged and otherwise comparable cohorts, that is, students aged 15–16 years in 2000 compared to same-aged students in, for instance, 2018.

All survey items used in PISA were originally written in English and French, and then adapted to the test languages of the participating countries. PISA have strict guidelines with regard to translation, adaptation, validation and verification of national versions (OECD 2017b). Swedish was the test language for students in Sweden.

3.2 Dependent Variable

As focal dependent variable, we use the PISA index of school belonging. Students are given six statements: (a) "I feel like an outsider (or left out of things) at school "; (b) "I make friends easily at school "; (c) "I feel like I belong at school "; (d) "I feel awkward or out of place in my school "; (e) "Other students seem to like me "; (f) "I feel lonely at school ". Response options range from "Strongly agree" (0), to "Strongly disagree" (3). Among these items (a), (c) and (d) may be said to capture students' general orientation to school, while (b), (e) and (f) refer more explicitly to the social environment in school, specifically peer relations.

Following the approach in PISA (OECD 2017b), we used a generalised partial credit model to combine the items into a scale measuring students' latent sense of belonging at school. Generalised partial credit models belong to the family of item response theory models, which measure latent, or unobservable, characteristics of respondents using multiple observed items, typically with the purpose of evaluating questionnaires and develop scales. Generalised partial credit models allow item discrimination as well as difficulty to vary across items (OECD 2017b). After reverse coding items (b), (c) and (e), we generated a unidimensional, continuous scale, with higher values indicating higher school belonging (mean = −0.02; standard deviation = 0.93; range = −2.64–1.64; Cronbach's alpha = 0.87).

The PISA index has been used in previous studies of school belonging (Chiu et al. 2016; Montt and Borgonovi 2018), and it captures the most salient features of the concept as defined in this study: whether students feel accepted and included in the school environment (OECD 2017a). However, it should be noted that the PISA index includes several items measuring students' perceptions of the social environment in school (e.g. quality of peer relations), but no items directly measuring students' perceptions of the learning environment (such as perceptions of the schoolwork). This imbalance should be kept in mind when interpreting the results.

3.3 Independent Variables

The first research objective concerns differences in temporal trends by gender, social and migration background, and levels of academic achievement. Gender is measured as a binary variable, with boy as the reference category. Social background is measured through the highest occupational status of the parents. This is based on open-ended questions of the occupations of the respondent's parents, and recoded into international socio-economic index of occupational status (ISEI) scores, with higher scores representing higher occupational status. The respondent is assigned the highest value of either parent. Occupational measures of social status are more reliable than measures based on parental education in surveys of adolescents (Engzell and Jonsson 2015). We center the index by year to hold changes in the occupational structure constant. As regards migration background, we distinguish between (1) native students, who are born in Sweden; (2) second generation immigrants, who are born in Sweden but with two foreign-born parents; and (3) foreign-born students, who are not born in Sweden and have foreign-born parents.

Academic achievement is measured by achievement in reading and mathematics (the latter only available for a sufficient number of students from 2003 onwards). In PISA, students only take a subset of the full assessment, and item response theory models are used to derive plausible values for the achievement score for each student based on

their score on their specific subset. We construct achievement scores by averaging the plausible values for each student (averaging the plausible values is recommended when the standard errors of the scores are not relevant; cf. Montt and Borgonovi 2018). Since achievement scores in PISA are rescaled such that the global PISA average in each survey is always 500, we center the scores by year so that they represent relative achievement within surveys. PISA scores are not directly comparable within countries across surveys.

The second research objective concerns the determinants of the trends, that is, if changes in exposures can account for changes in school belonging. Data on relevant exposures are comparatively poor in PISA, but several of the risk and protective factors identified in the research review can nonetheless be tested empirically. Specifically, PISA include indicators of teacher support, students' relations with their teachers, and disruptive behaviors in class (school disciplinary climate); all of which have been found to be associated with school belonging (e.g. Allen et al. 2018; Joyce 2018; OECD 2017a), and are of relevance from the perspective of stage-environment fit theory. PISA also include data on anxiety with regard to performance in mathematics, which we elaborate upon below.

Support from teachers is operationalised using the PISA index of (instructional) support from teachers (OECD 2017b). The index is based on three Likert items of the type "The teacher shows an interest in every student's learning", with response options ranging from "Never or hardly ever" (0) to "Every lesson" (3). We use a generalised partial credit model to generate a scale based on these items (mean=0.00; standard deviation=0.90; range=-2.36–1.18; Cronbach's alpha=0.83), with higher values indicating greater support.

Student–teacher relations are operationalised through a set of Likert items that measure students' perceptions of their relationships with teachers. We include five items of the type "Most teachers are interested in students' well-being", with response options ranging from "Strongly disagree" (0) to "Strongly agree" (3). Based on these, we generate a scale using a generalised partial credit model (mean=0.00; standard deviation=0.91; range=-2.70–2.11; Cronbach's alpha=0.86), with higher values indicating better relations. These items are only available in 2000, 2003 and 2012.

Disciplinary climate, or the extent of disruptive behaviors*,* is operationalized by the PISA index of disciplinary climate in school (OECD 2017b). The index is based on five Likert items of the type "There is noise and disorder in class", with response options ranging from "Every lesson" (0) to "Never or hardly ever" (3). Based on these, we generate a scale using a generalised partial credit model (mean=0.02; standard deviation=0.93; range=-2.40–1.94; Cronbach's alpha=0.83), with higher values indicating better disciplinary climate.

Mathematics anxiety: PISA moreover contain an index measuring to what extent students feel anxiety with regard to their performance in mathematics (OECD 2014), which in this context functions as a proxy for performance-oriented environments. The items capture worries in relation to academic performance and evaluation (e.g. grades and homework), and indirect theoretical as well as empirical work suggest that evaluative and performance-oriented environments lead to intensified social comparison and self-focus (Cortina et al. 2017; Eccles and Roeser 2011; Kumar 2006; von der Embse et al. 2018). The index is constructed from four Likert items of the type "I worry that I will get poor grades in mathematics", with response options ranging from "Strongly disagree" (0) to "Strongly agree" (3). We generate a scale using a generalised partial credit model (mean=−0.01; standard deviation=0.90; range=−2.48–1.65; Cronbach's alpha=0.80), with higher values indicating higher anxiety. Mathematics anxiety is only available in 2003 and 2012.

Among these indicators, teacher support, good relations with their teachers, and good disciplinary climate may be seen as protective factors for school belonging, while mathematics anxiety may be seen as a risk factor for low belonging. Most of the scales described have been used in previous studies on school belonging (Chiu et al. 2016), and have gone through strict validation procedures before being implemented in PISA surveys (OECD 2017b). All included items and variables are described in detail in Table S1 in the supplemental Online Resource.

3.4 Analytical Procedure

To address the first research objective, we use two empirical strategies. First, since we are interested in heterogeneities across the distribution of school belonging, that is, if there has been a trend towards divergence or convergence between students with low versus high school belonging, we use quantile regression to investigate the trends at different percentiles of the distribution. Specifically, we compare levels of belonging at the 10th, 25th, 50th (median), 75th, and 90th percentiles across all survey years. Second, to examine differential trends by gender, social and migration background, and academic achievement, we interact these variables with the time variable (one dummy variable for each survey year). The resulting interaction terms indicate whether trends differ across groups.

To address the second research objective, we investigate if the prevalence of, or exposure to, risk and protective factors with regard to school belonging has changed over time, and if these changes in turn have contributed to changes in school belonging (cf. Högberg et al. 2020; Sweeting et al. 2010). Specifically, we investigate this through mediation analysis within a regression framework, and analyse to what extent the explanatory variables (the measures of risk and protective factors) function as a mediators of the temporal trends in school belonging. We compare average (predicted) levels of school belonging in each survey year before and after the explanatory variables are included as covariates in the regression models. By including the exposures as mediators in the models, we hold their prevalence constant, and the degree of mediation can be examined by looking at the change in the coefficients for year (or time) across the different models when different mediating variables are included. The coefficient for year (time) in the models where the exposure is included can thus, assuming a causal relation between the exposure and the outcome, be interpreted as the predicted level of school belonging in a counterfactual scenario in which the level of the exposure did not change. Since the mediators are available in different years, we include them one by one in different models. Due to the clustering of students in schools, all models are random intercept (multilevel) linear regression models, with students (level 1) nested in schools (level 2), and random intercepts for schools.

To formally test the statistical significance of the indirect effects of the mediators, we use generalized structural equation models for multilevel data, with 5000 bootstraps replicates per model used to estimate the standard errors. To be consistent with how the indexes are used in PISA, we only use the path analysis part of the structural equation models (leaving out the measurement component), and include the indexes as observed variables in the models.

4 Results

4.1 Differential Trends

The first research objective was to investigate the characteristics of the temporal trends. Figure 1 illustrates heterogeneity across the distribution of school belonging, by displaying results from a range of quantile regression models, as well as results from a linear regression estimating the average value for comparison. The vertical axis shows levels of school belonging, while the horizontal axis shows how this has changed from 2000 to 2018 (note that we lack data from 2006 and 2009). Spikes around the point estimates for each year indicate 95% confidence intervals. Unless otherwise stated so, changes commented upon are significant at the conventional 5% level. Quantile regression estimates the effect of an independent variable at different quantiles of the distribution of the dependent variable. In this case, since Fig. 1 does not include any covariates besides survey year, the quantiles have a straightforward interpretation. The 50th percentile (median) shows the score for a student in the middle of the distribution, in each survey wave, the 90th percentile the score for a student at the 90th percentile, and so on.

Between 2000 and 2003, levels of school belonging were largely stable across the full distribution. Between 2003 and 2012, it dropped mainly at the lower parts of the distribution (10th, 25th and 50th percentiles), while between 2012 to 2015, the upper parts also declined somewhat, leading to a clear decrease in the average levels. The decline stabilized between 2015 and 2018. In 2015 and 2018, all parts of the distribution save for the very top (the 90th percentile), were lower than in 2000. However, the decline was greater at the bottom, leading to polarization and to a greater dispersion in 2015 and 2018. In other words, the average decline in school belonging, especially between 2003 and 2015, was primarily driven by a decline at the bottom half of the distribution. Another way to express the increasing dispersion and polarization is by comparing the standard deviation (a standard measure of variation) of the belongingness
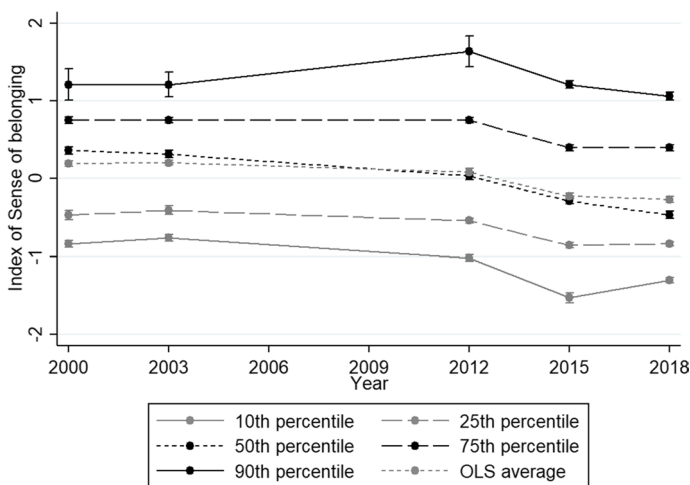

Fig. 1 Levels of school belonging, 2000–2018. Trends by percentiles. Data from PISA, 2000–2018. Spikes indicate 95% confidence intervals
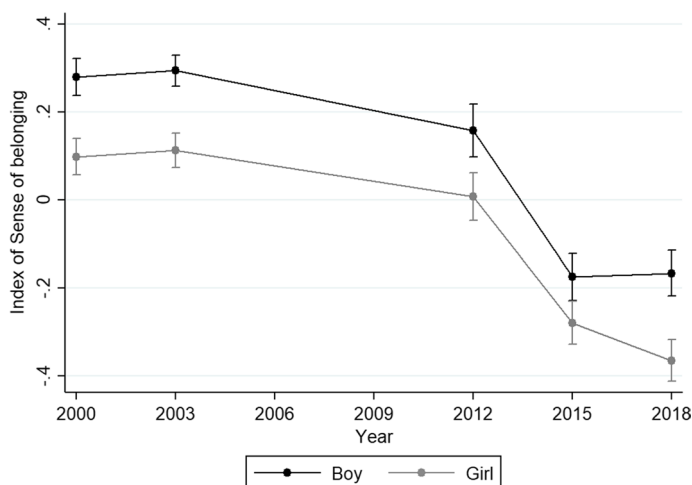
Fig. 2 Predicted levels of school belonging, 2000–2018. Trends by gender. Data from PISA, 2000–2018. Spikes indicate 95% confidence intervals
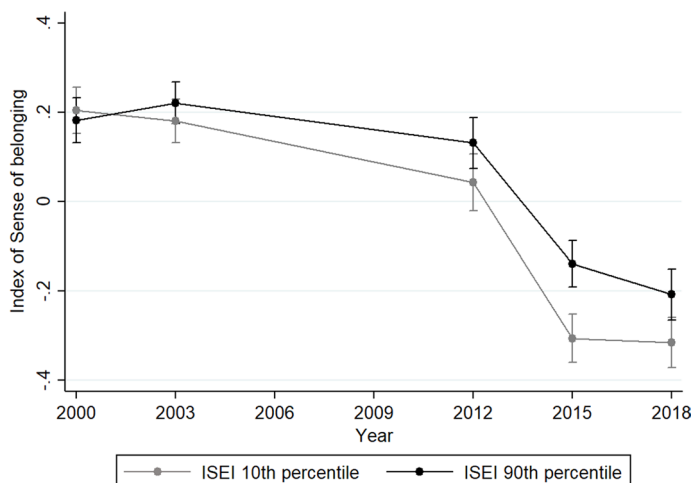

Fig. 3 Predicted levels of school belonging, 2000–2018. Trends by social background. Data from PISA, 2000–2018. Spikes indicate 95% confidence intervals

scale across different years. In 2000 and 2003, the standard deviation was 0.79–0.80. It then increased to 0.90 in 2012, 1.04 in 2015, and 0.94 in 2018 (not shown).

Figures 2, 3, 4 and 5 investigate differential trends across different groups, by showing predicted (average) levels of school belonging over time depending on gender, social and migration background, and academic achievement (estimated by multilevel linear regression models). Beginning with Fig. 2, we see that the decline from 2003 to 2015 was larger for boys than for girls, but due to an increase for boys after 2015, the gender difference was almost identical in 2000 and 2018. Figure 3 shows predicted levels for students at the 90th (higher) and 10th (lower) percentiles of the distribution of parental occupational
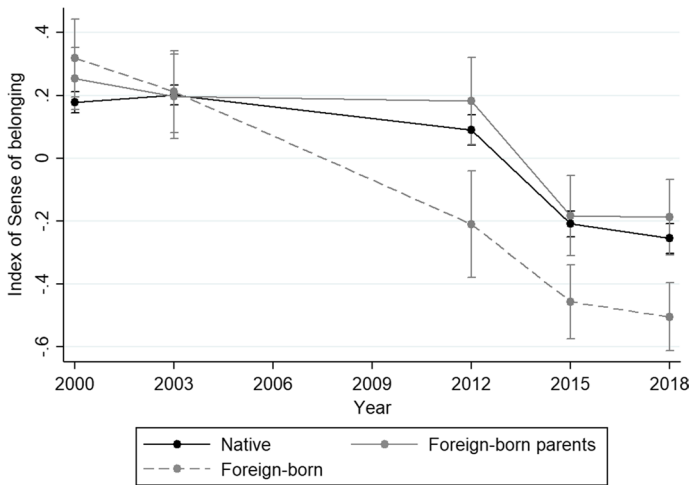
Fig. 4 Predicted levels of school belonging, 2000–2018. Trends by migration background. Data from PISA, 2000–2018. Spikes indicate 95% confidence intervals
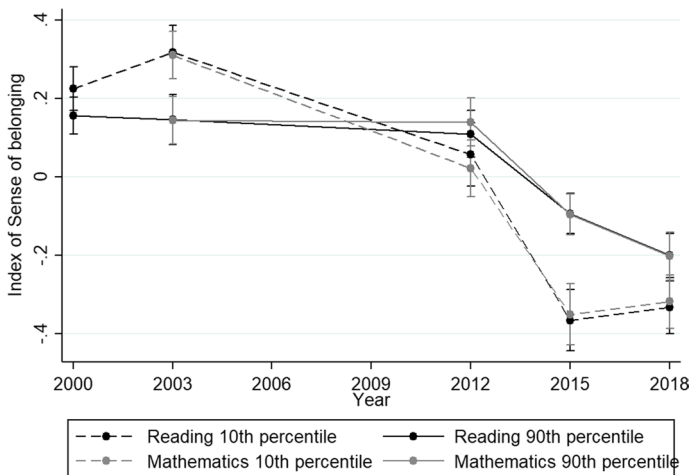

Fig. 5 Predicted levels of school belonging, 2000–2018. Trends by achievement level. Data from PISA, 2000–2018. Spikes indicate 95% confidence intervals

status (ISEI). In 2000 and 2003, there were no differences depending on social background, but by 2015 and 2018, a clear and significant gap had emerged, to the detriment of students from more disadvantaged backgrounds. Figure 4 shows that the decline was larger for foreign-born than for Swedish-born students. In 2000 and 2003, there were no significant differences depending on migration background, but from 2012 onwards, foreign-born students had clearly and significantly lower belonging on average. No relevant differences can be discerned between natives and 2nd generation immigrants.

Figure 5 shows predicted levels of school belonging for students at the 90th (higher) and 10th (lower) percentiles of reading and mathematics achievement, respectively. In 2000

and 2003, differences depending on achievement were small, and actually to the advantage of low-achieving students. However, after 2003 and especially after 2012, levels for low-achieving students declined rather dramatically, resulting in substantially lower levels of belonging for low- compared to for high-achieving students in 2015 and (less so) 2018. Another way to put this is that the effect of low achievement on school belonging became negative, and significantly stronger, after 2003.

In sum, Figs. 2, 3, 4 and 5 make clear that the decline in school belonging affected all groups of students, but also that it was greatest for students from disadvantaged social backgrounds, foreign-born students, and low-achieving students.

4.2 Mediation

The second research objective was to investigate the determinants of the temporal trends. We do this by including the focal explanatory variables (exposures) as mediators in a series of regression models, in Table 1. Model 1 shows the unadjusted temporal trend (no covariates), and model 2 the trend adjusted for demographic covariates (gender, and social and migration background). Note that, since the models in Table 1 include additional covariates, the sample is now restricted to observations with complete data on the explanatory variables. The coefficients for year (the temporal trend, with 2000 as the reference year) are almost identical in models 1 and 2, meaning that changed demographics cannot account for the decline. Model 3 adds teacher support, model 4 disciplinary climate, and model 5 student–teacher relations (not available in 2015 and 2018), along with the demographic covariates. Again, the coefficients for year only change slightly, and in all cases such that they become more negative. Thus, had disciplinary climate, teacher support and relations remained constant at their 2000 levels, the decline in school belonging would have been even greater. This is because students' perceptions of support from and relationships with teachers, and the disciplinary climate, improved over this period (see also Table 2), and, since these factors are positively associated with school belonging, they thereby *counteracted* the decline.

Model 6 shows the temporal trend with 2003 as reference year, adjusted for demographic covariates, and model 7 shows how this changes when accounting for mathematics anxiety (2003 is used as reference year since data on mathematics anxiety is not available in 2000). The year coefficient (the coefficient for 2012) in model 7 is reduced by almost one quarter compared to model 6, meaning that increased mathematics anxiety can account for a modest but noticeable part of the decline in school belonging between 2003 and 2012.

We test the significance of the indirect (mediated) effects through a series of generalized structural equation models, in Table 2. Table 2 includes three columns: (1) the effect of time (year) on the respective mediator, that is, the change in the level of the mediator from 2000 (or 2003) to 2018 (or 2012); (2) the unique effect of the respective mediator on school belonging (which is identical to the regression coefficients from Table 1); and (3) the indirect effect of the mediator, that is, the effect of time (year) on school belonging that can be accounted for by the mediator. The indirect effect is the product of the coefficients in columns (1) and (2). Table 2 only shows results for the first and last years for which we have data on the mediating variable.

In column 1, we see that that the levels of all four mediators has increased over time, meaning that the prevalence of all measured risk and protective factors has increased. In column 3, we see that the indirect effects of all mediators are significant at conventional levels ($p < 0.05$), but only in the case of mathematics anxiety is the indirect effect negative,

Table 1 Multilevel linear regression models with index of sense of belonging as the outcome

	m1		m2		m3		m4		m5		m6		m7	
	β	ρ	β	ρ	β	ρ	β	ρ	β	ρ	β	ρ	β	ρ
Year[a]											–	–	–	–
2003	0.030	0.274	0.032	0.247	0.015	0.582	0.006	0.826	0.000	0.864	–	–	–	–
2012	−0.099	0.001	−0.100	0.001	−0.139	0.000	−0.128	0.000	−0.182	0.000	−0.132	0.000	−0.101	0.000
2015	−0.396	0.000	−0.393	0.000	−0.426	0.000	−0.440	0.000						
2018	−0.447	0.000	−0.443	0.000	−0.487	0.000	−0.500	0.000						
Teacher support					0.143	0.000								
Disciplinary climate							0.121	0.000						
Student–teacher relations									0.231	0.000				
Mathematics anxiety													−0.173	0.000
Intercept	0.189	0.000	0.277	0.000	0.298	0.000	0.306	0.000	0.301	0.000	0.311	0.000	0.278	0.000
Demographic covariates included	No		Yes		Yes		Yes		Yes		Yes		Yes	
Intraclass correlation (school-level)	.096		.096		.093		.092		.100		.129		.135	
N (schools)	931		931		931		931		508		355		355	
N (individuals)	18,403		18,403		18,403		18,403		9,437		5,632		5,632	

Data from PISA, 2000–2018. Demographic covariates include gender, social background (parental occupational status), and migration background. β = beta coefficient from linear regressions. ρ = p-value. [a]Reference year is 2000 in m1–m5 and 2003 in m6–m7

Table 2 Generalized structural equation model with index of sense of belonging as the outcome

	(1) Effect of time on mediator		(2) Unique effect of mediator on school belonging		(3) Indirect effect: Effect of time on school belonging mediated by mediator	
	β	ρ	β	ρ	β	ρ
Time: Year 2018 versus 2000						
Mediator: Teacher support	0.314	0.000	0.143	0.000	0.045	0.000
Mediator: Disciplinary climate	0.486	0.000	0.121	0.000	0.059	0.000
Time: Year 2012 versus 2000						
Student–teacher relations	0.354	0.000	0.231	0.000	0.082	0.000
Time: Year 2012 versus 2003						
Mathematics anxiety	0.202	0.000	–0.173	0.000	–0.035	0.000

Estimated from 5000 bootstrapped replications. All indirect effects estimated with separate models. All models include demographic covariates: gender, social background (parental occupational status), and migration background

that is, contributing to and accounting for rather than counteracting the decline (column 3). Given the large sample size (around 4,000 per survey), the focus should be on the size of the indirect effects rather than their levels of significance. With the possible exception of the counteracting effect of student–teacher relations, the indirect effects are not very large compared to the overall decline in belonging.

4.3 Supplementary and Sensitivity Analyses

The analyses presented in Tables 1 and 2 have been restricted to complete cases, meaning that around 15% of the observations with data on school belonging were discarded. We have examined the sensitivity of the results to this choice by re-estimating the mediation models using multiple imputation, with 20 multivariate normal imputations. The results are largely similar with imputed values included (not shown).

We also show item-specific temporal trends in Figure S1 (supplemental Online Resource). The negatively worded items decline more, as do items related to the general orientation to school ("I feel like an outsider "; "I feel like I belong "; "I feel awkward or out of place ") compared to items related to peer relations. The differences between negatively and positively worded items, and between general orientation- and peer relation-items, are significant (p < 0.05).

5 Discussion

The study had two research objectives. (1) To investigate the characteristics of the Swedish temporal trends in school belonging, and (2) to investigate the determinants of these trends. With regard to the first objective, the results showed that belonging declined more for students at the bottom part of the distribution, leading to divergence and greater dispersion over time. The decline was also greatest for students from migration and disadvantaged

social backgrounds as well as for low-achieving students. Thus, school belonging in Sweden has become increasingly polarized across several dimensions. Moreover, the decline for students from disadvantaged social backgrounds and for low-achieving students was greatest after 2003 and (especially) after 2012, which coincides with the greatest increase in dispersion and the greatest decline in average levels of school belonging (see Fig. 1). In other words, the increased dispersion, and the declining average levels, seem to have been partly driven by a disproportionate decline in belonging for these students. With regard to the second objective, results showed that, with the exception of mathematics anxiety between 2003 and 2012, none of the explanatory variables related to disciplinary climate, or teacher support and relations, could account for the decline (that is, mediate the temporal trend). These protective factors have improved during this period, suggesting that explanations of the decline must be sought for elsewhere.

With limited data on explanatory factors, explanations regarding the causes of the observed trends are preliminary and should be seen as hypotheses to be investigated in future analyses. Nonetheless, the empirical results suggest that some interpretations are more consistent with the data than others. The mediation analyses showed that mathematics anxiety, which can be seen as a proxy for performance-oriented learning environments, alone among the explanatory variables contributed to the decline in belonging. Results also showed that the decline in belonging was greatest for low-achieving students, or in other words, that low achievement increasingly has become a risk factor for low school belonging. This could be because low-achieving students have become a more selected group, although this does not explain why the decline for these students remains after adjusting for demographic characteristics. It could also be because institutional changes in how schools operate have contributed to a learning environment in which low-achieving students feel more alienated, and the stigma attached to low achievement is more prominent. Although speculative, such changes could include stronger performance-orientation and higher demands (cf. Högberg et al. 2019), or stronger negative consequences from failing to meet the demands (e.g. stricter achievement-criteria for access to upper secondary education); an explanation that would be consistent with the greater mathematics anxiety.

The item-by-item analysis (Figure S1) also contributes with some pieces to solve the puzzle. The decline in item scores was stronger for items related to the general orientation to school ("outsider", "awkward" and "belong") compared to items pertaining to peer relations. While the wording of these statements is too general to offer support for any particular cause, the fact that items pertaining to peer relations declined less suggests that for instance bullying or disrupted social networks were probably not the most important drivers behind the overall decline in school belonging. Thus, using a process of elimination leads us to seek for explanations elsewhere, in which in the learning environment or the broader institutional structure of Swedish schools would come into focus.

Lack of suitable data in PISA makes it difficult to directly investigate the role of institutional factors. However, the timing of the trend in school belonging—moderate increase in polarization and decline in average levels between 2003 and 2012, sharper increase in polarization and decline in average levels between 2012 and 2015, and stabilization after 2015—suggests that any changes should have taken place in or around the years 2012–2015. This coincides with the previously described education reform in Sweden, implemented in 2011–2013. In short, the reform was characterized by an instrumental view of education, stricter grading standards and achievement-criteria for access to upper secondary education, an increased use of summative evaluation (including high-stakes national tests), and an overall stronger performance-orientation. Recent studies indicate that the reform contributed to more intense performance-orientation and social comparisons in

classrooms (Löfgren and Löfgren 2016), and to lower self-esteem, more stress and more mental health problems among students (Högberg et al. 2019).

An interpretation focusing on the role of this reform would also be consistent with stage-environment fit theory (Eccles and Midgley 1989). The strict and detailed standards, as well as the more instrumental view of education, may have restricted students' opportunities for autonomous development of competences, while the emphasis on evaluation, and the associated competitive and performance-oriented learning environment, may have led to more self-focus and social comparison among students. The disproportionate decline in belonging for low-achieving students is of particular interest in this regard, as the greater vulnerability of such students to evaluation and social comparison is an explicit prediction of stage-environment fit theory (Eccles and Midgley 1989). Related to this, previous research have found that students' perceptions of their academic competence mediate the effect of achievement on school satisfaction (Verkuyten and Thijs 2002). It is possible that stricter standards and evaluations, including stricter achievement-criteria for access to upper secondary education, disproportionately decreased the perceived competence of low-achieving students. This may also explain why the decline in belonging was greatest for students from migration or disadvantaged social backgrounds. Official statistics show that inequalities in academic achievement based on migration and social background have increased in Sweden over the last decades (Holmlund et al. 2019). If students from migration or disadvantaged social backgrounds have fallen behind in terms of achievement, and if the evaluation of achievement and performance becomes more central, we would expect these groups to be disproportionally affected. While suggestive, we emphasize that this interpretation is theoretically grounded and not directly based on data.

5.1 Limitations

The study has some important limitations. First, while PISA data contain the arguably longest time series of school belonging available for Swedish students, data on explanatory variables are more inadequate. PISA is ultimately aimed at measuring academic outcomes, and this is reflected in the collection of data. Data on many potentially important factors for school belonging are either lacking completely or only available in single surveys. Such potentially important factors include for instance bullying, which may have increased in Sweden since 2013 (Public Health Agency of Sweden 2018), or use of digital technology and social media. Related to this, the PISA index of school belonging may be seen as narrow, as it puts more weight on peer relations than on other aspects of belonging such as perceptions of the learning environment and schoolwork. Thus, results of this study may not be directly comparable to studies using more comprehensive measures (cf. Libbey 2004). School belonging, like all subjective measures broadly related to wellbeing, are also sensitive to cultural contexts, and the PISA approach to measuring this has been criticized for failing to take diverse cultural contexts into account (cf. Rappleye et al. 2019). School belonging is inherently a multifaceted phenomenon, and one-dimensional quantitative metrics may not do justice to the complexities of students' situation in school.

Second, PISA is a repeated cross-sectional survey, and the analysis is restricted to temporal trends across cohorts, not individuals. Related to this, the mediation analysis assumes a one-directional causal relationship between the explanatory variables and school belonging. To the extent that this is not the case, either due to confounding or reverse causality, the results in Tables 1 and 2 cannot be interpreted as causal mediation of the trend in school belonging.

Third, many newly arrived immigrants are, due to language barriers, excluded from participation in PISA (due to data restriction laws, the number is not known; OECD 2019b). Thus, the sample is not fully representative of the Swedish student population as a whole, possibly underestimating the decline in school belonging if foreign-born students have on average lower belonging and their share of the student population has increased. The composition of the foreign-born student population also changed between 2000 and 2018, with relatively more foreign-born students coming from a socio-economically disadvantaged background (Swedish National Agency for Education 2018). This group is thus not fully comparable over time.

5.2 Conclusions and Implications

This study has shown that school belonging declined dramatically in Sweden between 2003 and 2015. The decline was driven by a decline at the bottom part of the distribution, and was strongest for foreign-born students, students from disadvantaged social backgrounds and low-achieving students. The decline could not be accounted for by observable changes in demographics (social and migration background) or characteristics related to the school environment (teacher support and relations, and disciplinary climate). The decline did, however, coincide with a major education reform, characterized by an increased use of summative evaluation, and an overall stronger performance-orientation. Based on theory and previous research, we argue that this reform possibly contributed to the decline in school belonging, especially for low-achieving students due to their greater vulnerability to evaluation and comparison of achievement.

Based on this interpretation of the available evidence, an implication of this study would be that performance-oriented learning environments may have detrimental side effects on students' sense of belonging in school. Policymakers who value student belonging and overall wellbeing would in that case be advised to devise strategies to ameliorate such side effects of performance-oriented learning, or find alternative ways to raise achievement. The fact that Sweden in the 2000 and 2003 PISA surveys combined a top position in average school belonging with an above average level of academic achievement suggests that tradeoffs between student achievement and wellbeing are not an inevitable feature of education policy.

To the best of our knowledge, the study presents the first analysis of temporal trends in students' school belonging. Given the substantial decline in school belonging documented in many countries (OECD 2017a), and the importance of school belonging for a range of academic and developmental outcomes (Eccles and Roeser 2011; Markowitz 2017a), there is an urgent need for more research on the topic, from different educational contexts. Such research would benefit from using panel data, data with rich information on school characteristics, and cross-country comparative data, so as to be able to identify key determinants of the observed trends.

Decalarations

References

Allen, K., Vella-Brodrick, D., & Waters, L. (2016). Fostering school belonging in secondary schools using a socio-ecological framework. *The Educational and Developmental Psychologist, 33*(1), 97–121. https://doi.org/10.1017/edp.2016.5

Allen, K., Kern, M. L., Vella-Brodrick, D., Hattie, J., & Waters, L. (2018). What schools need to know about fostering school belonging: A meta-analysis. *Educational Psychology Review, 30*(1), 1–34. https://doi.org/10.1007/s10648-016-9389-8

Chiu, M. M., Chow, B.W.-Y., McBride, C., & Mol, S. T. (2016). Students' sense of belonging at school in 41 Countries:Cross-cultural variability. *Journal of Cross-Cultural Psychology, 47*(2), 175–196. https://doi.org/10.1177/0022022115617031

Collishaw, S. (2015). Annual research review: Secular trends in child and adolescent mental health. *Journal of Child Psychology and Psychiatry, 56*(3), 370–393. https://doi.org/10.1111/jcpp.12372

Cortina, K. S., Arel, S., & Smith-Darden, J. P. (2017). School belonging in different cultures: The effects of individualism and power distance. *Frontiers in Education, 2*(56). https://doi.org/10.3389/feduc.2017.00056

Eccles, J. S., & Midgley, C. (1989). Stage/environment fit: Developmentally appropriate classrooms for early adolescents. In R. E. Ames & C. Ames (Eds.), *Research on motivation in education* (pp. 139–186). Academic Press.

Eccles, J. S., & Roeser, R. W. (2011). Schools as developmental contexts during adolescence. *Journal of Research on Adolescence, 21*(1), 225–241. https://doi.org/10.1111/j.1532-7795.2010.00725.x

Engzell, P., & Jonsson, J. O. (2015). Estimating social and ethnic inequality in school surveys: Biases from child misreporting and parent nonresponse. *European Sociological Review, 31*(3), 312–325. https://doi.org/10.1093/esr/jcv005

Hodges, A., Cordier, R., Joosten, A., Bourke-Taylor, H., & Speyer, R. (2018). Evaluating the psychometric quality of school connectedness measures: A systematic review. *PLoS ONE, 13*(9), e0203373. https://doi.org/10.1371/journal.pone.0203373

Högberg, B., Lindgren, J., Johansson, K., Strandh, M., & Petersen, S. (2019). Consequences of school grading systems on adolescent health: evidence from a Swedish school reform. *Journal of Education Policy*, 1-23.https://doi.org/10.1080/02680939.2019.1686540

Högberg, B., Strandh, M., & Hagquist, C. (2020). Gender and secular trends in adolescent mental health over 24 years—The role of school-related stress. *Social Science & Medicine*, 250. https://doi.org/10.1016/j.socscimed.2020.112890

Holmlund, H., Sjögren, A., & Öckert, B. (2019). *Jämlikhet i möjligheter och utfall i den svenska skolan. [Equality of opportunity and outcome in the Swedish school system].* Statens offentliga utredningar (SOU), 2019: 40. Stockholm, Sweden

Joyce, H. D. (2018). Does school connectedness mediate the relationship between teacher support and depressive symptoms? *Children & Schools, 41*(1), 7–16. https://doi.org/10.1093/cs/cdy024

Kidger, J., Araya, R., Donovan, J., & Gunnell, D. (2012). The effect of the school environment on the emotional health of adolescents: A systematic review. *Pediatrics, 129*(5), 925–949. https://doi.org/10.1542/peds.2011-2248

Klinck, M., Vannucci, A., & Ohannessian, C. M. (2019). Bidirectional relationships between school connectedness and internalizing symptoms during early adolescence. *The Journal of Early Adolescence, 0*(0), 1–33. https://doi.org/10.1177/0272431619858401

Kuang, X., Mok, M. M. C., Chiu, M. M., & Zhu, J. (2019). Sense of school belonging: Psychometric properties and differences across gender, grades, and East Asian societies. *PsyCh Journal, 0*(0). https://doi.org/10.1002/pchj.275.

Kumar, R. (2006). Students' experiences of home–school dissonance: The role of school academic culture and perceptions of classroom goal structures. *Contemporary Educational Psychology, 31*(3), 253–279. https://doi.org/10.1016/j.cedpsych.2005.08.002

Libbey, H. P. (2004). Measuring student relationships to school: attachment, bonding, connectedness, and engagement. *Journal of School Health, 74*(7), 274–283. https://doi.org/10.1111/j.1746-1561.2004.tb08284.x

Löfgren, R., & Löfgren, H. (2016). *Att få sina första betyg: En rapport om elevers berättelser om sina erfarenheter av att få betyg i årskurs 6 [Receiving grades for the first time: A report on pupils experiences of grades in year 6].* Swedish National Agency for Education.

Lundahl, C., Hultén, M., & Tveit, S. (2017). The power of teacher-assigned grades in outcome-based education. *Nordic Journal of Studies in Educational Policy, 3*(1), 56–66. https://doi.org/10.1080/20020317.2017.1317229

Ma, X. (2003). Sense of belonging to school: can schools make a difference? *The Journal of Educational Research, 96*(6), 340–349. https://doi.org/10.1080/00220670309596617

Markowitz, A. J. (2017). Associations between school connection and depressive symptoms from adolescence through early adulthood: moderation by early adversity. *Journal of Research on Adolescence, 27*(2), 298–311. https://doi.org/10.1111/jora.12275

Markowitz, A. J. (2017a). Associations between emotional engagement with school and behavioral and psychological outcomes across adolescence. *AERA Open, 3*(3). https://doi.org/10.1177/2332858417712717

Markowitz, A. J. (2018). Changes in school engagement as a function of no child left behind: A comparative interrupted time series analysis. *American Educational Research Journal, 55*(4), 721–760. https://doi.org/10.3102/0002831218755668

Meece, J. L., Anderman, E. M., & Anderman, L. H. (2006). Classroom goal structure, student motivation, and academic achievement. *Annual Review of Psychology, 57*(1), 487–503. https://doi.org/10.1146/annurev.psych.56.091103.070258

Montt, G., & Borgonovi, F. (2018). Combining achievement and well-being in the assessment of education systems. *Social Indicators Research, 138*(1), 271–296. https://doi.org/10.1007/s11205-017-1644-y

OECD. (2014). *PISA 2012 Technical Report.* OECD Publishing, Paris.

OECD. (2017a). *PISA 2015 Technical Report.* OECD Publishing, Paris.

OECD. (2017b). *PISA 2015 Results (Volume III): Students' Well-Being.* OECD Publishing, Paris.

OECD. (2019b). *PISA 2018 Results (Volume I) What Students Know and Can Do.* OECD Publishing, Paris.

OECD. (2019a). *PISA 2018 Results (Volume III) What School Life Means for Students' Lives.* OECD Publishing, Paris.

OECD. (2020). *PISA 2018 Technical Report.* https://www.oecd.org/pisa/data/pisa2018technicalreport/. Accessed 13 October 2020.

Plank, S. B., & Condliffe, B. F. (2013). Pressures of the season: An examination of classroom quality and high-stakes accountability. *American Educational Research Journal, 50*(5), 1152–1182. https://doi.org/10.3102/0002831213500691

Rappleye, J., Komatsu, H., Uchida, Y., Krys, K., & Markus, H. (2019). 'Better policies for better lives'?: constructive critique of the OECD's (mis)measure of student well-being. *Journal of Education Policy*, 1–25.https://doi.org/10.1080/02680939.2019.1576923

Slaten, C. D., Ferguson, J. K., Allen, K.-A., Brodrick, D.-V., & Waters, L. (2016). School belonging: A review of the history, current trends, and future directions. *The Educational and Developmental Psychologist, 33*(1), 1–15. https://doi.org/10.1017/edp.2016.6

Sundberg, D. & Wahlström, N. (2015) Theory-based evaluation of the curriculum Lgr 11. *IFAU Working paper* 2015: 11

Public Health Agency of Sweden (2018). *Skolbarns hälsovanor i Sverige 2017/18. Grundrapport [Health behaviors of Achools-aged Children 2017/18: Report]*. Stockholm: Sweden.

Swedish National Agency for Education. (2018). *Analyser av familjebakgrundens betydelse för skolresultaten och skillnader mellan skolor [The importance of family background for school results and variations across schools]*. Report 467. Stockholm: Sweden.

Swedish National Agency for Education. (2019). *PISA 2018–15-åringars kunskaper i läsförståelse, matematik och naturvetenskap [PISA 2018 – Reading, mathematics and science performance among Swedish 15-year olds]*. Stockholm.

Sweeting, H., West, P., Young, R., & Der, G. (2010). Can we explain increases in young people's psychological distress over time? *Social Science and Medicine, 71*(10), 1819–1830. https://doi.org/10.1016/j.socscimed.2010.08.012

Verkuyten, M., & Thijs, J. (2002). School Satisfaction of elementary school children: The role of performance, peer relations, ethnicity and gender. *Social Indicators Research, 59,* 203–228. https://doi.org/10.1023/A:1016279602893

von der Embse, N., Jester, D., Roy, D., & Post, J. (2018). Test anxiety effects, predictors, and correlates: A 30-year meta-analytic review. *Journal of Affective Disorders, 227,* 483–493. https://doi.org/10.1016/j.jad.2017.11.048

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.