Scandinavian Journal of Educational Research

ISSN: 0031-3831 (Print) 1470-1170 (Online) Journal homepage: www.tandfonline.com/journals/csje20

Heterogeneity in school stress trajectories? A comparative analysis of cohorts across educational contexts

Cristian Bortes, Joanna Giota & Björn Högberg

To cite this article: Cristian Bortes, Joanna Giota & Björn Högberg (31 Mar 2026): Heterogeneity in school stress trajectories? A comparative analysis of cohorts across educational contexts, Scandinavian Journal of Educational Research, DOI: 10.1080/00313831.2026.2648985

To link to this article: https://doi.org/10.1080/00313831.2026.2648985

© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

View supplementary material

Published online: 31 Mar 2026.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at https://www.tandfonline.com/action/journalInformation?journalCode=csje20

SCANDINAVIAN JOURNAL OF EDUCATIONAL RESEARCH
https://doi.org/10.1080/00313831.2026.2648985

Routledge
Taylor & Francis Group

OPEN ACCESS Check for updates

Heterogeneity in school stress trajectories? A comparative analysis of cohorts across educational contexts

Cristian Bortes [a,b,c], Joanna Giota [b] and Björn Högberg [a,d]

[a]Department of Social Work, Uppsala University, Uppsala, Sweden; [b]Department of Education and Special Education, University of Gothenburg, Gothenburg, Sweden; [c]Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden; [d]Centre for Demographic and Ageing Research (CEDAR), Umeå University, Umeå, Sweden

ABSTRACT

This study examined the development of school-related stress across two student cohorts in Sweden: one educated under a less performance-oriented system, and the other under a more performance-oriented system characterised by earlier grading and increased assessments. Drawing on longitudinal survey data and register-linked sociodemographic variables, growth mixture modelling identified distinct trajectories of stress development, from school year 6 to school year 12. The findings reveal both shared and cohort-specific stress patterns, with stress levels converging by the end of upper secondary school despite divergent early trajectories. Gender, socioeconomic background, and migration background predicted trajectory memberships, though the strength of these associations varied between cohorts. Girls, as well as students from lower socioeconomic backgrounds regardless of gender, in the later cohort were more likely to belong to high-stress trajectories, suggesting that reforms between the two cohorts may have exacerbated disparities on school-related stress.

ARTICLE HISTORY
Received 9 June 2025
Accepted 10 March 2026

KEYWORDS
School stress; academic stress; trajectories; educational policy; adolescents; cohort comparison; longitudinal study; growth mixture modelling

Introduction

Despite growing recognition of school-related stress as a central concern in both adolescent (Steare et al., 2023) and educational research (Jagiello et al., 2025; Wuthrich et al., 2020), existing literature on the topic has two major limitations.

First, while much research has focused on mean levels of school stress among students at the population or group level (Cosma et al., 2022) and temporal trends (Högberg & Strandh, 2024; Klinger et al., 2015; Löfstedt et al., 2020), no studies to date have explicitly examined the longitudinal developmental trajectories of school stress throughout compulsory schooling and upper secondary education. Thus, while we know that older adolescents report higher stress levels compared to younger students (Jagiello et al., 2025; Wuthrich et al., 2020) and that these levels have increased over time (Högberg & Strandh, 2024; Klinger et al., 2015; Löfstedt et al., 2020), it remains unclear whether this is a uniform pattern across all students as they progress through the education system, or if distinct subgroups experience different stress trajectories.

CONTACT Cristian Bortes cristian.bortes@uu.se Department of Social Work, Uppsala University, Uppsala, Sweden; Department of Education and Special Education, University of Gothenburg, Gothenburg, Sweden; Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden

Supplemental data for this article can be accessed online at https://doi.org/10.1080/00313831.2026.2648985.

© 2026 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

Second, whereas most previous research on academic stress and related constructs (e.g., school burnout) has focused on individual psychological predictors (e.g., motivation, emotional regulation; Jagiello et al., 2025; Lee & Lee, 2018; Vansoeterstede et al., 2023), relatively few studies have explored how systemic or structural factors (e.g., curriculum design, assessment regimes) shape stress development (cf. Högberg, 2024). Existing studies have thus largely overlooked the role of educational structures and policies in shaping students' stress development.

To address these gaps, this study models the development of school-related stress across a broad developmental window, from early adolescence (around age 13) through late adolescence (around age 19), spanning both lower and upper secondary education.

From a policy perspective, understanding how school stress develops over time is essential. For instance, the introduction of earlier grades in Swedish schools in 2011/2012 was motivated by the idea that receiving grades at a younger age could help students habituate to the grading system, potentially reducing grade-related stress in the long term (Swedish Parliament, 2009). This study is the first to empirically test this assumption by comparing the developmental trajectories of two cohorts of students: one that received grades from school year 8 and another that received grades from school year 6. In doing so, this study offers insights into how structural changes in assessment systems may influence the development of school stress. Specifically, we address the following research questions:

1. How does school-related stress develop from school year 6 to school year 12 among students in Sweden?
2. Do distinct subgroups of students follow different developmental trajectories of school-related stress?
3. Do these trajectories differ between cohorts educated under a less versus a more performance-oriented system?
4. To what extent do gender, socioeconomic background, and migration background predict trajectory membership, and have these associations changed between cohorts?

Research background

School-related stress

According to Lazarus and Folkman's (1984) stress model, stress responses arise from a perceived inability to adequately cope with a situation that is appraised as threatening or challenging. These responses can be understood as reflecting an imbalance between external demands and internal coping resources. School-related stress, in turn, refers to stress responses to perceived demands related to school, particularly schoolwork and academic achievements, i.e., academic stress (Jagiello et al., 2025; Wuthrich et al., 2020). It is typically conceptualised as multidimensional, involving achievement-related pressures, perceptions of an excessive workload, concerns regarding internal or external expectations (e.g., from teachers and parents), worries related to future prospects (e.g., that realisation of one's life plans is dependent on academic success), and, more generally, a fear of failing in school (e.g., Ang & Huan, 2006; Byrne et al., 2007; Eriksen, 2021; Låftman et al., 2013; Östberg et al., 2015; Spencer et al., 2018; Sun et al., 2011). Although stress can, in certain situations, improve motivation and effort (i.e., eustress), qualitative research indicates that students themselves view school-related stress as a mostly negative experience (i.e., as distress; Banks & Smyth, 2015; Røsand & Klomstén, 2024), often associating it with broader psychosomatic or mental health complaints such as headaches, stomachaches, depressive moods, and anxiety (Östberg et al., 2015). By *developmental* trajectories of school stress, we refer to the patterns of change in students' experiences of school-related stress over time during their education, capturing how stress levels evolve throughout different stages of schooling.

Previous research on heterogeneous school stress trajectories

To the best of our knowledge, no study has explicitly examined the longitudinal trajectories of school stress and how they potentially vary across subgroups of students, at least not at the primary and secondary school levels (cf. Giota & Gustafsson, 2017, 2021). Existing studies on school-stress development mainly focus on college students or the transition to higher education (e.g., Liu et al., 2023; Zhao et al., 2023), and research on developmental trajectories in earlier stages of education remain scarce. In particular, there is a lack of studies investigating heterogeneity in the development of school stress. To find studies relevant to school-related stress, we must turn to a related construct such as school burnout. School burnout is a psychological syndrome resulting from chronic school stress, characterised by emotional exhaustion (persistent fatigue and mental strain due to academic demands), cynicism (detachment and a diminished sense of schoolwork's value), and feelings of inadequacy (reduced self-efficacy; Vansoeterstede et al., 2023).

However, even in the field of school burnout, a systematic review (Vansoeterstede et al., 2023) found only four studies that conducted trajectory analyses across samples from China, Finland, and South Korea, focusing on different educational levels and time points (Lee & Lee, 2018; Salmela-Aro & Upadyaya, 2014; Zhou et al., 2019). These studies identified two to four distinct trajectories, with most students following favourable trajectories, such as stable or slightly increasing moderate/low burnout levels (60%−85.4%). Unfavourable trajectories, including increasing or dramatically increasing burnout, appeared in all studies, affecting 3.9%−32% of the samples. Additionally, three of these studies identified trajectories with decreasing burnout levels, such as 10.7% of lower secondary students in Zhou et al. (2019), and 8% of adolescents transitioning from lower to upper secondary school in Salmela-Aro and Upadyaya (2014). Overall, previous research on school burnout suggests that it manifests in multiple distinct trajectories. Thus, we can expect heterogeneity in developmental patterns also when it comes to more general school-related stress. However, given the very limited number of related studies conducted so far, further research is needed to better understand the diverse pathways of school-related stress over time.

The Swedish educational context: Cohort 1998 and Cohort 2004

A key structural factor of interest in this study, in relation to students' school stress trajectories, is the shift in assessment systems that occurred during the educational reform period in Sweden around the years 2011–2014. In addition to new curricula, these reforms introduced a new grading scale, which included the introduction of a "fail" grade, formal grades being given from grade 6 (age 12) rather than from grade 8 (age 14), and an expanded national testing programme that included more frequent tests across more subjects and at earlier grade levels. This shift in assessment practices created what some have described as an "intensified assessment paradigm" (Hirsh, 2020), which placed greater emphasis on performance monitoring and assessment.

While both cohorts experienced parts of these systemic changes, the timing and extent of exposure to them differed. For Cohort 1998, reforms started to be implemented during their lower secondary years (grades 7-9), meaning they only experienced parts of the reforms during their schooling. In contrast, Cohort 2004 was exposed to the full scope of the new grading system and national testing throughout their entire compulsory schooling.

A key difference between the two cohorts is the timing of when they began receiving grades: Cohort 1998 started receiving grades in 8th grade, while Cohort 2004 began in 6th grade. Consequently, Cohort 2004 was exposed to grading for a longer period during their schooling, receiving grades for twice as long as Cohort 1998. Previous research suggests that the increased frequency of testing and grading that took place during these reform years had a negative impact on students' mental health (Högberg et al., 2021), and presumably, also on their school-related stress (Giota & Gustafsson, 2017)

Internationally, grading and assessment from early grades are common, but evidence suggests that students' stress is primarily linked to the *stakes* attached to assessment rather than its mere presence or frequency (OECD, 2017; Robson et al., 2023). Comparative reviews document large

cross-national differences in the function of grades, ranging from formative feedback tools to instruments of selection and accountability (Lundahl et al., 2017a). In high-stakes contexts (e.g., England), age-graded tests directly affect student progression, whereas in systems with more teacher-based assessment and limited selection stakes (e.g., Flanders), formal tests carry less direct consequence for students (Jackson & Van Houtte, 2025; cf. Jerrim, 2021). Accordingly, the potential impact of early grading likely depends on the role grades play in selection processes (Banks & Smyth, 2015; Högberg & Horn, 2022). In Sweden, this selection function is particularly pronounced: grades have long been used for high-stakes purposes (Lundahl et al., 2017b), with final compulsory-school grades determining access to upper-secondary tracks. Qualitative research further demonstrates how these stakes influence everyday classroom life, fostering a sense of being constantly assessed (Hirsh, 2020).

In the Swedish context, this became even more pronounced during the reform period discussed here. Academic pressures were further intensified by the introduction of stricter eligibility requirements for upper secondary education. Previously, passing grades in three subjects (Swedish, English, and mathematics) were sufficient for eligibility, whereas the reforms required students to pass at least twelve subjects for university-preparatory programmes and eight subjects for vocational programmes. This policy shift substantially raised the stakes of grading and led to an increase in the proportion of students failing to meet the entry requirements (Halapuu, 2021; Swedish Government Official Reports, 2019).

Overall, these reforms contributed to a system that placed greater emphasis on monitoring, measuring and documenting students' performance in school. This focus on assessable results and stricter learning objectives has been a trend not only in Sweden but also internationally over the past two decades (Sahlberg, 2016; Wetterstrand et al., 2017). Consequently, final grades from compulsory school gained a more significant role, directly influencing students' ability to progress within the educational system. The proportion of students failing to meet the requirements for entry into national programmes increased from 12.3% to 16.9% in 2016, a development that may reflect the combined effects of these policy changes together with broader societal and educational factors (Swedish Government Official Reports, 2024).

Both cohorts experienced their upper secondary education under the same curriculum, Gy11. The Swedish upper secondary school is a three-year programme, with students choosing between university-preparatory programmes or vocational tracks. Regardless of the chosen track, the Gy11 curriculum provided a common framework and grading system for both Cohort 1998 and 2004. Students received grades for each subject course every term, and national tests were given in key subjects, including Swedish, English, and mathematics. These assessments, alongside course grades, had an important role in determining students' final grades and their eligibility for further tertiary education.

As students near the end of their upper secondary school years, stressors increasingly shift towards concerns about life after graduation. While academic pressure, the need to meet performance expectations, and the pursuit of high grades remain important, more immediate concerns about what will happen after graduation also emerge (PHAS, 2018; Swedish Government Official Reports, 2024). This shift in stressors represents an important aspect of school-related stress during final stages of upper secondary school, where external factors, such as career prospects and societal pressure to succeed, become more pronounced and begin to weigh heavily on students' mental well-being. Previous research has highlighted that these shifts in stressors are key factors contributing to the rise in mental health problems from adolescence to young adulthood (Gustafsson et al., 2010; PHAS, 2018).

Method

Data

Data from the Evaluation Through Follow-up (ETF) survey were used. ETF is a repeated longitudinal survey on different cohorts of students in Sweden, conducted by Statistics Sweden in

collaboration with University of Gothenburg (Härnqvist, 2000). A representative sample of approximately 10% of all the students enrolled in school year 3 in Sweden (roughly 10,000 students) is drawn and subsequently followed through three survey waves: in school years 6 and 9 of compulsory school, and in year 12, the final year of upper secondary school. The representativeness thus refers to the initial sampling frame at baseline, while attrition occurred across waves (see Supplementary Tables A1-A3 for response rates and missing-data patterns). The sampling procedure involves two steps: first, a stratified sample of municipalities, followed by a selection of schools within each of the chosen municipalities.

For Cohort 1998, the first survey took place in the spring of 2011 when students were in 6th grade. The sample at this time point consisted of 9180 students, and a total of 8007 completed the questionnaire (87% response rate). The second survey took place in the spring of 2014, when the students were in 9th grade, and 4573 students responded (47% response rate). The final survey took place in the spring of 2017, when students were in their third and final year of upper secondary school, with 3553 student responses (37% response rate).

For Cohort 2004, the first survey took place in the spring of 2017 when students in where in 6th grade. The sample at this time point consisted of 9613 students, and a total of 5247 students completed the questionnaire (55% response rate). The second survey took place in the spring of 2020, when students were in 9th grade, resulting in 2523 student responses (26% response rate). The final survey for Cohort 2004 took place in the spring of 2023, when students were in their third and final year of upper secondary school. This survey was completed by 1924 students (20% response rate).

Both Cohort 1998 and Cohort 2004 completed the questionnaires in year 6 in the classroom, guided by their class teachers. All other surveys, in year 9 and upper secondary school, for both cohorts, were sent to the students, with the option to complete them either via paper or an online (digital) survey. The low response rate for Cohort 2004 can be attributed to the Covid-19 pandemic.

Attrition analysis

We conducted logistic regression analyses to examine whether attrition at T3 (1 = attrition; 0 = retention) was systematically related to baseline characteristics. Predictors included demographic variables (i.e., sex, migrant background, and socioeconomic status (SES) and school-related stress at T1 and T2, estimated separately for each cohort.

The results showed that, for Cohort 1998, sex (OR = 1.77, $p < 0.001$, 95% CI: 1.54-2.05), migrant background (OR = 0.53, $p < 0.001$, 95% CI: 0.43-0.64) and SES (OR = 1.50, $p < 0.001$, 95% CI: 1.32–1.71) were significant predictors of attrition at T3 (Nagelkerke $R^2 = 0.029$). Similarly, for Cohort 2004, sex (OR = 1.39, $p = 0.003$, 95% CI: 1.12–1.73), migrant background (OR = 0.63, $p = 0.005$, 95% CI: 0.46–0.87), and SES (OR = 1.63, $p < 0.001$, 95% CI: 1.32–2.00), were also significant predictors of attrition (Nagelkerke $R^2 = 0.020$). None of the school-related stress variables predicted missingness at T3. That is, in both cohorts, female students, native-born students, and those from higher socioeconomic backgrounds were somewhat more likely to drop out by T3. However, the small proportion of explained variance (2.9% or less) suggests that attrition is unlikely to have biased the overall findings.

Taken together, dropout at T3 was largely accounted for by demographic factors, whereas baseline and mid-study stress levels were unrelated to attrition. This supports the assumption that data were missing at random (MAR), as missingness was not systematically related to the primary variables of interest.

Dependent variable: school-related stress

School stress was measured using a single indicator. In school year 6, students were asked, "How do you feel in school?" In school years 9 and 12 of upper secondary school, the question was phrased as "How do the following statements describe your situation in school?" with "I feel stressed" as the

focal item. The response options in school year 6 were: "Never", "Almost never", "Sometimes", "Almost always", and "Always". In school years 9 and 12 of upper secondary school, the response options were: "Never/almost never", "Rarely", "Sometimes", "Often", and "Always/almost always". The questions and response alternatives were identical across the two cohorts.

While single-item indicators generally have lower reliability and narrower content coverage than multi-item scales, research shows that students interpret the concept of *school-related stress* mainly in relation to academic demands, assessments, and performance pressure, and as involving emotional, psychosomatic, and physiological reactions (Røsand & Klomstén, 2024; Perming et al., 2022; Anniko et al., 2019; Östberg et al., 2015; Låftman et al., 2013; Putwain, 2009). These reactions correspond with the transactional model of stress (Lazarus & Folkman, 1984) and with dimensions measured by multi-item instruments (Ang & Huan, 2006; Byrne et al., 2007). Moreover, previous research has shown that a comparable single stress item correlates strongly with both factors derived from a detailed 11-item stress inventory for Swedish adolescents (Lindblad et al., 2008). Also, this indicator is essentially the same as the one used in the international Health Behaviour in School-aged Children (HBSC; World Health Organization, 2020) studies, which strengthens its relevance and comparability. Overall, this measure provides a valid indicator of students' general experience of stress in the school context.

Predictors

Along with identifying distinct trajectories of school-related stress and comparing how these potentially differ between the cohorts, the analysis also explores the role of sociodemographic variables, such as gender, socioeconomic background, and migrant background, in predicting membership in these trajectories. In this way, the analysis seeks to explore whether the role of these core factors has changed between the two cohorts, offering insights into how their influence on school stress may have varied across different educational contexts.

In line with international classifications (OECD, 2023; UNESCO, 2012), parental education, used here as a proxy for socioeconomic background (Sirin, 2005), was dichotomised according to the ISCED 2011 classification (UNESCO, 2012) as tertiary (ISCED 5-8) versus non-tertiary (ISCED 0-4). Migration background was coded in line with PISA's immigrant-background classifications (OECD, 2023), collapsed into two categories: native (student and both parents born in Sweden) and immigrant-origin (first- or second-generation; the student and/or at least one parent born abroad). Gender (sex) was measured by a binary variable (0 = boy, 1 = girl). Data for these variables were drawn from administrative registers and linked to the survey measures.

Data analyses

As a preliminary step, a latent growth curve model (LGCM) was estimated to assess the overall change pattern, i.e., the growth curve, of school-related stress. Subsequently, to examine potential subgroups with distinct developmental trajectories of school-related stress, we applied growth mixture modelling (GMM) in Mplus (Muthén & Muthén, 1998/2017). This method allows for the identification of latent classes within a heterogenous population based on individual developmental trajectories over time. Rather than assuming that all individuals follow the same growth curve, GMM simultaneously estimates separate growth parameters for each latent class and assigns individuals to classes based on their longitudinal data patterns (Jung & Wickrama, 2008).

Competing GMMs (two-class, three-class, four-class solutions) were then compared using various model fit indices (Nylund et al., 2007). Specifically, we used the Bayesian Information Criterion (BIC), where lower BIC values indicate a better-fitting model. We also considered entropy, which provides an estimate of classification accuracy, with values closer to 1 indicating that individuals are clearly assigned to a specific class. Additionally, the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMRT-LRT) was employed to compare models with k classes to one with k-1 classes. The null

hypothesis states that the k-1-class model fits the data equally well as the k-class model; thus, a statistically significant p-value ($p < 0.05$) indicates that the model with an additional class fits the data significantly better.

Following the determination of latent classes, we examined mean-level differences in observed stress levels across trajectories. Individual posterior class memberships were derived from the Mplus model output, and one-way ANOVA tests with Bonferroni-adjusted pairwise comparisons were then conducted for each measurement point (T1-T3) within each cohort. Subsequently, a multinomial logistic regression analysis was performed to investigate how gender, socioeconomic background, and migration background, predicted membership in the different stress trajectories.

Models were estimated using robust maximum likelihood (MLR), which provides standard errors and test statistics robust to non-normality (Muthén & Muthén, 1998/2017). Missing data were handled using full information maximum likelihood (FIML) estimation under the assumption that data were missing at random (MAR). This assumption was considered reasonable, as the attrition analysis indicated that dropout was primarily associated with demographic factors rather than the key study variables. Seven missing data patterns were identified for the repeated measures of school stress (see Tables A2-A3 in the Supplementary materials for details). Covariance coverage ranged from 0.40 to 0.90 in Cohort 1998 and from 0.19 to 0.77 in Cohort 2004, both exceeding the recommended 0.10 threshold for reliable FIML estimation (Little et al., 2002; Schafer & Graham, 2002). Thus, even when data were missing at one or more time points, participants were retained in the analyses provided they had sufficient data on class indicators. See Table A1 in the Supplementary materials for descriptive statistics for all study variables.

Results

Latent growth curve model

Before estimating mixture models, a single-class LGCM was fitted separately for each cohort to evaluate the overall change structure. Model fit was relatively poor (Cohort 1998: RMSEA = 0.13, CFI = 0.81, SRMR = 0.06; Cohort 2004: RMSEA = 0.10, CFI = 0.89, SRMR = 0.05), suggesting that (i) assuming linear change and (ii) population homogeneity provides a suboptimal representation of the data.

Nevertheless, parameter estimates indicated a clear overall increase in school-related stress across both cohorts. For Cohort 1998, the mean intercept was 2.46 (SE = 0.01, $p < 0.001$) and the mean slope 0.66 (SE = 0.01, $p < 0.001$), indicating a relatively low initial level but a pronounced increase in stress over time. For Cohort 2004, the mean intercept was somewhat higher, 2.85 (SE = 0.02, $p < 0.001$), while the slope was smaller, 0.41 (SE = 0.01, $p < 0.001$), suggesting that students in the later cohort started from a higher baseline level of school stress but experienced a more gradual increase.

Moreover, the variances of both intercept and slope were statistically significant (Cohort 1998: intercept variance = 0.44, slope variance = 0.29, both $p < 0.001$; Cohort 2004: intercept variance = 0.66, slope variance = 0.24, both $p < 0.001$), indicating substantial inter-individual differences in initial stress levels and rates of change. These results suggest that there might be unique subgroups of students who follow different trajectories of school-related stress over time.

Mixture models: trajectory class enumeration

To determine the optimal number of latent classes representing distinct school stress trajectories, we conducted a class enumeration procedure separately for each cohort (1998 and 2004). Given that the two cohorts were exposed to different curricular and assessment systems during their compulsory schooling, as described above, we deemed it necessary to identify the number of classes independently in each cohort. The rationale for this approach assumes that school stress may

have developed differently depending on the educational structures in place during students' schooling. Therefore, running separate enumeration procedures allows for detecting cohort-specific patterns in school stress development rather than imposing a common class structure across both cohorts. This is particularly relevant given the changes introduced in the Swedish compulsory school system, such as increased performance monitoring, i.e., more frequent national tests and earlier grades, which could have influenced stress trajectories differently across cohorts.

Table 1 presents fit indices used to determine the optimal number of latent classes for each cohort. In both cohorts, the Bayesian Information Criterion (BIC) decreased as the number of classes increased, indicating improved model fit. Additionally, entropy values, which measure classification accuracy, suggested that models with three or more classes had relatively strong class separation. The Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT) was used to assess whether adding an additional class significantly improved model fit.

For Cohort 1998, the four-class solution was selected as the optimal model. The BIC dropped substantially from the three-class to the four-class model, and entropy increased to 0.92, indicating a well-defined classification. The VLMR-LRT was statistically significant for up to four classes and remained significant for the five-class solution ($p = 0.38$). However, based on factors such as theoretical interpretability, parsimony, and class stability (cf. Nylund et al., 2007), we retained the four-class solution rather than moving to a five-class model. The additional fifth class was substantively similar to an existing class and did not provide a theoretically meaningful distinction. Additionally, the entropy value slightly decreased in the five-class model (0.89 vs. 0.92), suggesting a marginal reduction in classification accuracy. Given these considerations, the four-class model was deemed the best balance between statistical fit and theoretical utility.

For Cohort 2004, the three-class solution was selected as the optimal model. Although the BIC continued to decrease with additional classes, the decline was marginal between the three-class and four-class models (see Table 1). The VLMR-LRT remained statistically significant for the four-class solution ($p < 0.001$), suggesting that adding a fourth class provided some improvement in fit. However, entropy values decreased (0.55 vs 0.59), indicating that classification certainty was slightly lower for the four-class model. Additionally, upon examining the class structured, the fourth class appeared to be a minor variation of an existing trajectory rather than representing a distinct stress pattern. Given these considerations (the small additional model improvement, lower classification certainty, and weaker substantive differentiation of the fourth class), the three-class solution was deemed to be the most parsimonious and interpretable model for Cohort 2004.

As a supplementary analysis, we also ran the class enumeration procedure by combining both cohorts into a single population, then conducting the multinomial regression with Cohort (1 = 1998, 2 = 2004) as a predictor. The rationale for this supplementary analysis was to assess overall patterns of school stress across the two cohorts, while also testing the role of cohort membership on trajectory assignment. Given potential cohort-level differences beyond individual covariates, we included Cohort as a predictor of class membership in the combined model to assess cohort-related variation in trajectory prevalence net of observed sociodemographics. This approach helps to further understand the relative contribution of cohort-specific influences versus overarching patterns of school stress development. The results from this analysis are presented in Supplementary materials (Tables A6-A8) and are discussed below.

Table 1. Criteria used to decide on optimal solution for number of latent classes.

Model	Cohort 1998			Cohort 2004		
	BIC	Entropy	*p*-value VLMR-LRT	BIC	Entropy	*p*-value VLMR-LRT
1-class	46859.22	–	–	31068.26	–	–
2-class	46614.75	0.36	0.0000	30905.63	0.44	0.0000
3-class	46257.75	0.73	0.0000	**30681.88**	**0.59**	**0.0000**
4-class	**38946.92**	**0.92**	**0.0000**	30663.54	0.55	0.0002
5-class	38967.12	0.89	0.0387	29271.09	0.36	0.0075

BIC: Bayesian Information Criterion; VLMR-LRT: Voung-Lo-Mendell-Rubin likelihood ratio test. Selected class solution in bold.

Subgroups of school stress trajectories

The analysis identified three common school stress trajectories in both cohorts, suggesting a similar overall structure in how stress develops over time. However, despite this shared classification, important differences emerged between cohorts in terms of the proportion of students in each trajectory, their initial stress levels, and the rates of change (Table 2). Additionally, a fourth trajectory was unique to Cohort 1998. The trajectory patterns are illustrated in Figure 1 for Cohort 1998 and Figure 2 for Cohort 2004.

Low stress-rapidly increasing

This trajectory, characterised by very low initial stress followed by a sharp increase, was present in both cohorts but different in size and starting levels. In Cohort 1998, 16.4% of students (n = 1422) followed this pattern, starting at the lowest level (intercept = 1.00) and showing the steepest increase (slope = 1.28). In Cohort 2004, this trajectory was substantially larger (36.9% of students, n = 2464) and had a higher initial stress level (intercept = 1.66), though the rate of increase was slightly lower (slope = 0.88). These findings suggest that while this stress pattern existed in both cohorts, students in Cohort 2004 began with higher baseline stress levels and exhibited a slightly more moderate acceleration in stress over time.

High stress-slightly declining

This trajectory was characterised by consistently high stress levels that declined only marginally over time. The proportion of students in this class was larger in Cohort 2004 (24.5%, n = 1639)

Table 2. Growth estimates and class sizes for school-related stress trajectories.

Class name	Cohort 1998				Cohort 2004			
	n	Proportions	Intercept	Slope	n	Proportions	Intercept	Slope
Class 1	1422	16.4%	1.00	1.28	2464	36.9%	1.66	0.88
Class 2	905	10.4%	4.36	–0.26	1639	24.5%	4.44	–0.26
Class 3	3317	38.2%	3.00	0.47	2581	38.6%	3.00	0.38
Class 4	3040	35.0%	2.00	0.85	–	–	–	–

Note: All intercepts and slopes estimates were statistically significant at $p < 0.001$.

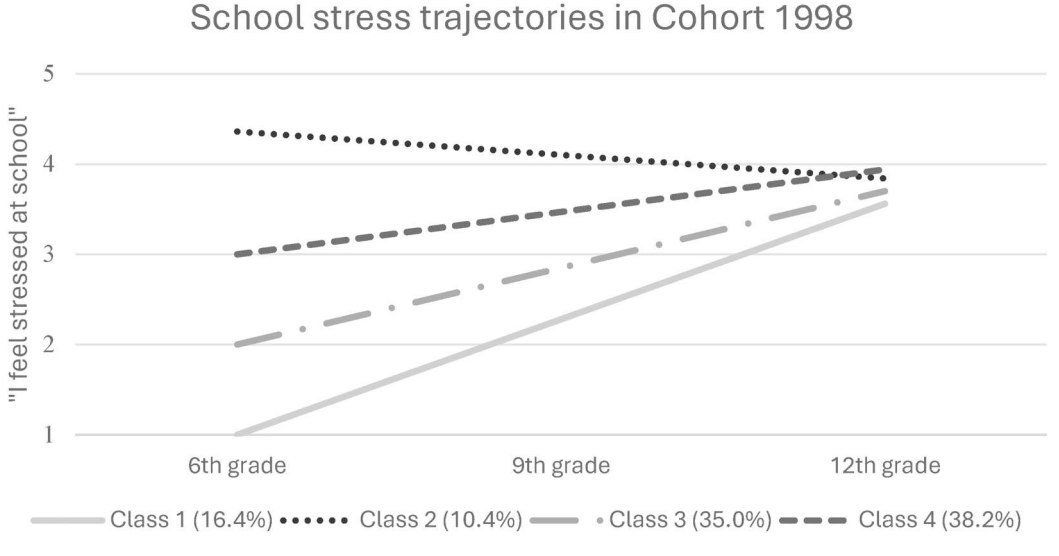

Figure 1. Trajectory patterns of school stress in Cohort 1998. Class 1 = *Low stress-Rapidly increasing* (Starts very low, then increases rapidly), Class 2 = *High stress-Slightly declining* (Starts very high, then declines a little), Class 3 = *Gradual stress-Increasing* (Starts at a moderate level and increases at a noticeable but not extreme rate), Class 4 = *Moderate stress-Increasing* (only observed in Cohort 1998; A noticeable, but not extreme increase in stress).

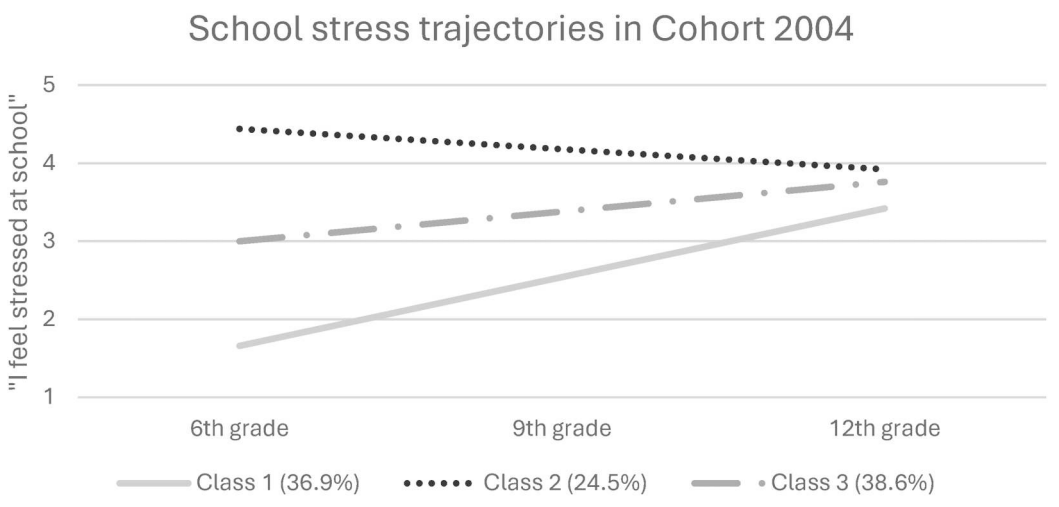

Figure 2. Trajectory patterns of school stress in Cohort 2004. Class 1 = *Low stress-Rapidly increasing* (Starts very low, then increases rapidly), Class 2 = *High stress-Slightly declining* (Starts very high, then declines a little), Class 3 = *Gradual stress-Increasing* (Starts at a moderate level and increases at a noticeable but not extreme rate).

than in Cohort 1998 (10.4%, n = 905). Initial stress levels were almost identical across cohorts (intercept = 4.36 in 1998 and 4.44 in 2004), and the rate of decline was minimal (slope = – 0.26 in both cohorts). Notably, this minor decrease in stress was smaller than the rate of change/increase observed in any other trajectory, meaning that students in this class remained the most highly stressed over time. Also, the larger proportion of students in this trajectory in Cohort 2004 suggests that (under Lgr11) a greater number of students experiences persistently high stress, with only slight relief over time.

Gradual stress-increasing

This trajectory represented students who began with moderate stress levels that gradually increased over time. It was the largest trajectory in both cohorts (38.2% in Cohort 1998, n = 3317; 38.6% in Cohort 2004, n = 2581). While the general pattern of gradual stress increase was consistent across cohorts, some differences emerged. The initial stress level was lower in Cohort 1998 (intercept = 2.00) compared to Cohort 2004 (intercept = 3.00). Moreover, the rate of increase was slightly steeper in Cohort 1998 (slope = 0.47) than in Cohort 2004 (slope = 0.38).

Moderate stress-increasing (only in Cohort 1998)

This trajectory was unique to Cohort 1998, comprising 35.0% of students (n = 3040). It was characterised by a moderate initial stress level (intercept = 3.00) and more noticeable, though not extreme, increase in stress over time (slope = 0.85). The absence of this trajectory in Cohort 2004 suggests a reduction in the heterogeneity of stress development patterns across students, i.e., that stress trajectories became more homogenised in the later cohort, with fewer students exhibiting moderate but distinct increase in stress. Instead, they may have been absorbed into either the *Gradual stress-Increasing* trajectory or the *Low stress-Rapidly increasing* trajectory, leading to a more uniform distribution of stress development patterns over time. However, this may reflect both a true reduction in heterogeneity in stress development patterns and a result of the smaller sample size and the associated reduced precision in latent class identification (Nylund et al., 2007). With fewer observations in Cohort 2004, the model might have been less able to detect distinct stress patterns that appeared in Cohort 1998.

To further examine whether the identified latent trajectories differed in observed stress levels, one-way ANOVA tests were conducted, based on posterior probability-derived class memberships

(see Tables A5-A6). For Cohort 1998, significant mean differences in school-related stress were observed across all measurement points (all $p < 0.001$). At T1, all four trajectories differed significantly from each other. By T2 and T3, the two trajectories characterised by higher stress levels remained significantly higher than the lower-stress trajectories. Similarly, in Cohort 2004, stress levels differed significantly across the three identified trajectories at each time point (all $p < 0.001$). Students in the *High stress-Slightly declining* trajectory consistently reported higher stress than those in the moderate or low-stress trajectories, with a clear separation between the three trajectories maintained through T3.

Predictors of school stress trajectories

Table 3 presents the results from the multinomial logistic regression analysis, examining how demographic factors predicted membership in the school stress trajectories. The trajectory class *Gradual stress-Increasing* was selected as the reference category in both cohorts, for two main reasons. First, this trajectory was observed across both cohorts and included a substantial proportion of students, making it a prevalent and representative stress trajectory. Second, it was characterised by moderate initial stress levels and a gradual increase over time, distinguishing it from more extreme trajectories (e.g., *Low stress-Rapidly increasing*, which exhibited the steepest increase, and *High stress-Slightly declining*, which was marked by persistently high stress levels). Thus, *Gradual stress-Increasing* provides a meaningful reference category for evaluating the factors associated with deviations toward the more "extreme"/unusual stress patterns.

Gender differences in class membership

Gender was a significant predictor of school stress trajectory membership in both cohorts. Compared to *Gradual stress-Increasing*, boys were substantially more likely to belong to the *Low stress-Rapidly increasing* in Cohort 1998 (OR = 4.64, $p < 0.001$) and Cohort 2004 (OR = 5.77, $p < 0.001$). This suggests that boys were overrepresented among students who initially reported very low stress but experienced a steep increase over time. In contrast, girls were significantly more likely than boys to belong to *High stress-Slightly declining* (OR = 0.24 in 1998 and OR = 0.25 in 2004, both $p < 0.001$), indicating a greater likelihood of experiencing persistently high stress despite a slight reduction over time. In Cohort 1998, gender was also a significant predictor of *Moderate stress-Increasing*, the trajectory class only observed in 1998, with boys being more likely than girls to follow this trajectory (OR = 2.43, $p < 0.001$).

Migration background

Migration background was a less consistent predictor of stress trajectory membership across cohorts. In Cohort 1998, students with a migration background were significantly more likely than native-born students to be in *Low stress-Rapidly increasing* (OR = 1.70, $p < 0.01$) compared to *Gradual stress-Increasing*. However, migration background did not significantly predict membership in *High stress-Slightly declining* (OR = 1.06, $p = 0.76$) or *Moderate stress-Increasing* (OR = 1.29, $p = 0.14$).

A similar pattern was observed in Cohort 2004, where students with a migration background were more likely to belong to *Low stress-Rapidly increasing* compared to *Gradual stress-Increasing* (OR = 1.41, $p < 0.05$). However, migration status was not significantly associated with *High stress-Slightly declining* (OR = 1.13, $p = 0.66$), indicating that migration background played a limited role in differentiating between stress trajectories.

Socioeconomic background

Socioeconomic background was significantly associated with *High stress-Slightly declining* in both cohorts. Students whose parents had lower educational attainment were more likely to follow this trajectory compared to *Gradual stress-Increasing* in both Cohort 1998 (OR = 0.74, $p < 0.01$)

Table 3. Results from the multinomial logistic regressions predicting class membership by Cohort.

Predictor	Cohort 1998 (vs. Class 3)						Cohort 2004 (vs. Class 3)			
	Class 1		Class 2		Class 4		Class 1		Class 2	
	B (SE)	OR [95% CI]	*B* (SE)	OR [95% CI]	*B* (SE)	OR [95% CI]	*B* (SE)	OR [95% CI]	*B* (SE)	OR [95% CI]
Gender	1.54 (0.10) ***	4.64 [3.86-5.62]	−1.42 (0.14) ***	0.24 [0.19-0.32]	0.89 (0.10) ***	2.43 [2.05-2.99]	1.75 (0.13) ***	5.77 [4.50-7.33]	−1.39 (0.20) ***	0.25 [0.17-0.37]
Migration background	0.53 (0.16) **	1.70 [1.26-2.31]	0.06 (0.20)	1.06 [0.72-1.58]	0.25 (0.17)	1.29 [0.91-1.74]	0.34 (0.16) *	1.41 [1.04-1.95]	0.12 (0.29)	1.13 [0.68-2.01]
SES	−0.06 (0.09)	0.94 [0.79-1.12]	−0.31 (0.11) **	0.74 [0.59-0.92]	−0.02 (0.09)	0.99 [0.84-1.21]	−0.22 (0.10) *	0.80 [0.65-0.98]	−0.33 (0.16) *	0.72 [0.53-0.98]

Note: *B* = logistic regression coefficient; SE = standard error; OR = odds ratio; CI = Confidence Interval; SES = Socioeconomic status.
The reference category is Class 3 (*Gradual stress-Increasing*) in both Cohort 1998 and Cohort 2004.
Gender is coded 1 = boy, 2 = girl; Migration background 1 = no, 2 = yes; Socioeconomic status 1 = low, 2 = high.
Class 1 = "Low stress-Rapidly increasing"; Class 2 = "High stress-Slightly declining"; Class 3 = "Gradual stress-Increasing"; Class 4 = "Moderate stress-Increasing" (only observed in Cohort 1998). *$p < 0.05$, **$p < 0.010$, ***$p < 0.001$.
Class 1 = "Low stress-rapidly increasing" (Starts very low, then increases rapidly); Class 2 = "High stress-slightly declining" (Starts very high, then declines a little); Class 3 = "Gradual stress-increasing" (Starts at a moderate level and increases at a noticeable but not extreme rate); Class 4 = "Moderate stress-increasing" (only observed in Cohort 1998; A more noticeable, but not extreme increase in stress, stronger than "gradual" but not as steep as "rapid").

and Cohort 2004 (OR = 0.72, $p < 0.05$). These findings suggest that students with lower parental education levels were more likely to experience persistently high school stress. Parental education was also a significant predictor of *Low stress-Rapidly increasing* in Cohort 2004 (OR = 0.80, $p < 0.05$), but this association was not present in Cohort 1998 (OR = 0.94, $p = 0.36$). This suggests that the role of socioeconomic factors in stress development may have become more pronounced in later cohorts.

Supplementary analysis

The supplementary analysis identified, similar to the separate cohort analyses, a four-class solution as the optimal model (Table A4), with the overall structure of the trajectories remaining consistent (Table A5). Cohort membership predicted trajectory class membership, suggesting that cohort-specific factors, such as earlier grading in Cohort 2004, shaped stress experiences in distinct ways (Table A6). Specifically, Cohort 2004 students were less likely to belong to Class 1 (*Low stress-Rapidly increasing*) compared to Class 3 (*Moderate stress-Increasing*). This indicates that Cohort 1998 students, with lower initial stress levels in school year 6, experienced a quicker increase in stress in the following years. A reasonable interpretation of this finding is that the previously discussed reforms, which were gradually implemented around the Cohort 1998s lower secondary years (school years 7-9), led to an increase in stress for these students after school year 6. This may have been due to their increased exposure to the demands and pressures of increased national testing, stricter eligibility criteria for upper secondary schooling, and other associated changes that occurred after they completed school year 6. In contrast, Cohort 2004 students were significantly more likely to belong to Class 2 (*High stress-Slightly declining*) compared to Class 3, suggesting that these students had higher stress levels already from the outset and maintained a consistently high level of stress throughout their schooling.

Discussion

Motivated by existing research on school-related stress, which has primarily focused on average stress levels and temporal trends but lacks insight into how stress develops and varies across different subgroups of students throughout their education, this study investigated the diverse pathways of school-related stress across two cohorts in Sweden.

We found multiple trajectories in school-related stress in both cohorts, demonstrating that stress, as expected, does not follow a uniform pattern across all students. Instead, students exhibit distinct stress profiles. Specifically, in both cohorts, we found patterns that included trajectories of initially low stress with a rapid increase, initially moderate stress with a gradual increase, and a group with initially high stress that showed a slight decline over time, though the latter exhibited such small reductions that it could be considered a group with chronically high stress that remained rather stable over time. This suggests that stress trajectories are not only diverse but that some students experience persistent high school-related stress throughout their education, which is certainly concerning.

The overall structure of these stress trajectories was similar across the two cohorts, which is noteworthy. However, despite the similarities in the overall stress trajectory structures, there were notable differences in the *distribution* of students across these trajectories between the two cohorts. Specifically, Cohort 2004, which experienced earlier grading and more frequent testing, had a larger proportion of students in the *Low stress-Rapidly increasing* trajectory, and a higher proportion of students in the *High stress-Slightly declining* (the chronically high stress) trajectory. In contrast, Cohort 1998 had a higher proportion of students in the "moderate" and "gradual stress increase" trajectory, which likely reflects a more gradual development of school-related stress in the context of a less achievement-oriented educational system.

These findings allow us to reflect on one of the policy assumptions underpinning the 2011/2012 educational reforms, specifically the idea that earlier exposure to grading would help students habituate

to performance evaluation and, over time, reduce grade-related stress (Swedish Parliament, 2009). By comparing two cohorts, one that received grades from school year 8 and another that received grades from school year 6, this study offers an opportunity to empirically test that proposition.

However, our results provide limited support for such a mechanism. In fact, Cohort 2004, which received grades starting from school year 6, was exposed to grading from an earlier age, as the policy change started with birth cohorts from 2000 onward. Despite this, Cohort 2004 not only showed higher initial stress levels in the *Low stress-Rapidly increasing* trajectory but also had a larger proportion of students in *both* this and in the *High stress-Slightly declining* (the chronically high stress) trajectory, compared to Cohort 1998 (who received grades starting from school year 8). This suggests that, contrary to the intended effect of "habituation", earlier exposure to grading may not have reduced stress but rather contributing to an earlier onset and longer duration of school-related stress for a larger proportion of students than before.

At the same time, stress levels in the final year of upper secondary school converged across cohorts, and were not significantly higher in Cohort 2004 than in Cohort 1998. This implies that although stress accumulated earlier in Cohort 2004 for a larger proportion of students, it did not necessarily translate into higher long-term stress. Thus, earlier grading did not reduce stress in the younger grades and seems to have frontloaded stress earlier in the educational trajectory, but it also did not result in sustained increases in stress by the end of schooling.

Another notable finding is the previously mentioned *convergence* in school stress levels observed by the third measurement point (in year 12 of upper secondary school). Despite considerable variation between subgroups at the first measurement point (in school year 6), all groups in both cohorts had rather similar levels of stress by the third measurement point, indicating a trend towards commonality in stress experiences by the end of upper secondary schooling. The fact that most trajectories showed an increase over time is consistent with much previous research, showing that older adolescents report higher levels of school-related stress (Jagiello et al., 2025; Wuthrich et al., 2020), suggesting a general increase in perceived stress as students' progress through upper secondary education (Lee & Lee, 2018).

However, our findings also introduce something new: it is not simply a matter of parallel increases in stress between each trajectory. Rather, it reflects different patterns of stress development that ultimately lead to similar stress levels across subgroups by the end of their upper secondary schooling. Some trajectories show a steep increase in stress, while others show a more gradual rise or even a slight decline, yet nearly all groups appear to experience some form of stress accumulation by the end of upper secondary school. This may be driven by the increased academic and future-oriented demands faced by students in these years (Byrne et al., 2007; Krogh, 2023), regardless of their initial stress levels. This finding suggests that while individual trajectories of school stress may differ early on, there may be a shared experience of stress as students approach adulthood (cf. Krogh, 2023; Røsand & Klomstén, 2024).

The observed convergence could also be due to a "ceiling effect": as the stress variable was measured on a 5-point scale, many students who reported high levels of stress early on (in year 6) may have reached the maximum value on the scale, thus limiting the ability to capture further increases in their stress levels. This ceiling effect could have contributed to the similar stress levels observed by the third measurement point, as students who started with high stress were unable to report any higher levels, even if their stress continued to accumulate. Thus, the observed convergence in stress levels may reflect both a true trend toward shared stress experiences and the limitations of the measurement scale.

A related methodological consideration concerns regression toward the mean. While latent growth and mixture models are less prone to this phenomenon because they model change within individuals over time (Ram & Grimm, 2009), some regression-to-the-mean effects may still occur, especially among students with initially extreme stress levels (cf. Barnett et al., 2005).

Regarding the predictors of school stress trajectories, gender, socioeconomic background, and migrant background were all significant predictors of trajectory membership, in line with previous

research indicating that these factors influence students' stress experiences (Lindblad et al., 2008; Östberg et al., 2015; Parviainen et al., 2021; Vansoeterstede et al., 2023). In both cohorts, girls were more likely to belong to the *High stress-Slightly declining* group, suggesting that girls experience higher or more sustained levels of school stress compared to boys. This is consistent with much previous research showing that girls generally report higher levels of school-related stress (Löfstedt et al., 2020; Östberg et al., 2015; see also García-Moya et al., 2025). While the effect of gender is fairly consistent across both cohorts, the proportional differences are somewhat greater in Cohort 2004. Migration background predicted membership in the *Low stress-Rapidly increasing* trajectory in both cohorts, but the effects were somewhat more pronounced in Cohort 1998.

Socioeconomic background was also a significant predictor in both cohorts, though its impact on stress trajectories varied. In Cohort 1998, a lower socioeconomic background was associated with the *Moderate stress-Increasing* trajectory, indicating a gradual increase in stress over time. In contrast, Cohort 2004 had a different pattern, with students from lower socioeconomic backgrounds more likely to belong to *both* the *Low stress-Rapidly increasing* and *High stress-Slightly declining* trajectories. This suggests that in Cohort 2004, students from lower socioeconomic backgrounds were more likely to experience extreme stress trajectories, whether characterised by rapid stress accumulation or sustained high levels of stress.

Taken together, there were both similarities and differences between the cohorts regarding the relationship between sociodemographic factors and school stress trajectories. Notably, while gender had a consistent effect across both cohorts, a larger proportion of girls in Cohort 2004 belonged to the trajectory with sustained high stress levels (*High stress-Slightly declining*), and Cohort 2004 showed more pronounced effects for students from lower socioeconomic backgrounds. This may suggest that changes in the education system, that occurred between the periods during which the two cohorts attended school, could have contributed to amplifying the effects of certain sociodemographic factors, disproportionately affecting girls and those from lower socioeconomic backgrounds.

Limitations

The findings of this study should be considered in light of its limitations. First, school stress was measured using a single indicator, providing less specificity than multi-item scales.

Second, the study adopted a comparative approach, contrasting two cohorts that experienced different educational contexts, one before and the other after significant changes in the Swedish compulsory school system: specifically, the introduction of earlier grading for the later cohort. While this comparison highlights differences in student outcomes between educational contexts, completely isolating the effects of these reforms from other potentially influential factors, such as social trends (e.g., social media) or socioeconomic changes, remains challenging. Moreover, the mechanisms through which educational structures influence stress are likely multifaceted, e.g., classroom-level implementation, teacher practices, and individual differences in students' stress resilience. These aspects cannot be fully captured by the present study design but merit investigation in future studies, including potential interactions between key sociodemographic factors. Future studies could also include additional predictors, to capture a broader range of influences on school-stress development.

Third, while having three measurement points of school stress is highly valuable, it limits the ability to model only linear forms of trajectories. Future research with additional data points could provide insights into more complex patterns, such as accelerations, where stress levels might increase at a faster rate at certain points, or non-linear patterns, where stress development might not follow a consistent straight path but instead periods of rapid change or stabilisation. Furthermore, the long intervals between measurement points mean that changes such as transitions to new schools, teachers or peer groups, as well as broader age-related changes could also contribute to students' experiences of school stress.

Fourth, as with all mixture modelling approaches, inferences about latent classes warrant appropriate caution (Bauer & Curran, 2003a, 2003b). Regarding the number of identified trajectories in each cohort, these should be viewed as statistical approximations of underlying heterogeneity with probabilistic membership, and should not be over-interpreted as fixed subpopulations or discrete groups.

Given these considerations, replication using other datasets is essential to assess the robustness and generalisability of the identified trajectories. An important avenue for future research is therefore to re-examine developmental patterns of school-related stress across cohorts and educational contexts to determine whether the trajectory structures observed here reflect stable underlying processes or cohort- and context-specific phenomena. Ideally, such research could also extend beyond upper secondary school to explore how these developmental pathways relate to later life outcomes, such as transitions into adulthood.

Conclusions

This study examined how school-related stress developed over time for students in two different cohorts, within the context of educational reforms implemented in Swedish compulsory schools between the periods these cohorts attended school. We observed varying patterns of stress development between the cohorts, which, as we interpret it, may be attributed to differing curricular focus, assessment, and grading systems in place during their schooling.

Students in Cohort 2004, who were exposed to earlier grading, increased evaluations, and more performance monitoring, generally reported higher and more sustained levels of stress compared to those in Cohort 1998. Girls, particularly in Cohort 2004, were more likely to belong to high stress trajectories, suggesting that the changes in the education system between the two cohorts may have had a disproportionate impact on female students. Furthermore, students from lower socioeconomic backgrounds in Cohort 2004 were more likely to belong to extreme stress trajectories, indicating that the reforms may have increased disparities in school-related stress based on students' family background.

Regarding policy implications, given the negative effects of school-related stress on students' health and well-being (e.g., Anniko et al., 2019; Tharaldsen et al., 2023), this study adds to previous research highlighting the importance of also considering non-academic outcomes when implementing educational reforms. To mitigate the risk of exclusion in the long-run, due to mental health issues, policymakers should consider the potential effects of reforms on school-related stress.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by the Swedish Research Council [grant number 252509706 – VR, 2022-03525]; the Swedish Research Council for Health, Working Life and Welfare [grant number 2022-01062].

Data availability statement

Data are not available for public use. Please see the Evaluation Through Follow-up website for more information: https://www.gu.se/en/evaluation-through-follow-up

ORCID

Cristian Bortes http://orcid.org/0000-0001-6008-2296
Joanna Giota http://orcid.org/0000-0002-7385-845X
Björn Högberg http://orcid.org/0000-0002-0199-0435

References

Ang, R. P., & Huan, V. S. (2006). Academic expectations stress inventory: Development, factor analysis, reliability, and validity. *Educational and Psychological Measurement*, *66*(3), 522–539. https://doi.org/10.1177/0013164405282461

Anniko, M. K., Boersma, K., & Tillfors, M. (2019). Sources of stress and worry in the development of stress-related mental health problems: A longitudinal investigation from early – to mid-adolescence. *Anxiety, Stress, & Coping*, *32*(2), 155–167. https://doi.org/10.1080/10615806.2018.1549657

Banks, J., & Smyth, E. (2015). 'Your whole life depends on it': Academic stress and high-stakes testing in Ireland. *Journal of Youth Studies*, *18*(5), 598–616. https://doi.org/10.1080/13676261.2014.992317

Barnett, A. D., van der Pols, J. C., & Dobson, A. J. (2005). Regression to the mean: What it is an how to deal with it. *International Journal of Epidemiology*, *34*(1), 215–220. https://doi.org/10.1093/ije/dyh299

Bauer, D. J., & Curran, P. J. (2003a). Distributional assumptions of growth mixture models: Implications for over-extraction of latent trajectory classes. *Psychological Methods*, *8*(3), 338–363. https://doi.org/10.1037/1082-989X.8.3.338

Bauer, D. J., & Curran, P. J. (2003b). Overextraction of latent trajectory classes: Much ado about nothing? Reply to Rindskopf (2003, Muthén (2003), and Cudeck and Henly (2003) *Psychological Methods, 8*(3), 384–393. https://doi.org/10.1037/1082-989X.8.3.384

Byrne, D. G., Davenport, S. C., & Mazanov, J. (2007). Profiles of adolescent stress: The development of the adolescent stress questionnaire (ASQ). *Journal of Adolescence*, *30*(3), 393–416. https://doi.org/10.1016/j.adolescence.2006.04.004

Cosma, A., Stevens, G. W. J. M., Vollebergh, W. A. M., & De Looze, M. (2022). Time trends in schoolwork pressure among Dutch adolescents, 2001–2017: Gender and educational differences. *Scandinavian Journal of Public Health*, *50*(5), 538–541. https://doi.org/10.1177/14034948211018388

Eriksen, I. M. (2021). Class, parenting and academic stress in Norway: Middle-class youth on parental pressure and mental health. *Discourse: Studies in the Cultural Politics of Education*, *42*(4), 602–614.

García-Moya, I., Paniagua, C., & Jiménez-Iglesias, A. (2025). Gender differences in adolescent school stress: A mixed-method study. *Journal of Research on Adolescence*, *35*(1), e13057. https://doi.org/10.1111/jora.13057

Giota, J., & Gustafsson, J.-E. (2017). Perceived demands of schooling, stress and mental health: Changes from grade 6 to grade 9 as a function of gender and cognitive ability. *Stress and Health*, *33*(3), 253–266. https://doi.org/10.1002/smi.2693

Giota, J., & Gustafsson, J.-E. (2021). Perceived academic demands, peer and teacher relationships, stress, anxiety and mental health: Changes from grade 6 to grade 9 as a function of gender and cognitive ability. *Scandinavian Journal of Educational Research*, *65*(6), 956–971. https://doi.org/10.1080/00313831.2020.1788144

Gustafsson, J.-E., Allodi, M. W., Alin Åkerman, B., Eriksson, C., Eriksson, L., Fischbein, S., & … Persson, R. S. (2010). School, learning and mental health: A systematic review. *The Royal Swedish Academy of Sciences. The Health Committee*, 1–179.

Halapuu, V. (2021). *Access to education and disability insurance claims (IFAU working paper 2021:17).* Institutet för arbetsmarknads – och utbildningspolitisk utvärdering.

Härnqvist, K. (2000). Evaluation through follow-up. A longitudinal program for studying education and career development. In C.-G. Janson (Ed.), *Seven longitudinal studies in behavioural science* (pp. 76–114). Forskningsrådsnämnden.

Hirsh, Å. (2020). When assessment is a constant companion: Students' experiences of instruction in an era of intensified assessment focus. *Nordic Journal of Studies in Educational Policy*, *6*(2), 89–102. https://doi.org/10.1080/20020317.2020.1756192

Högberg, B. (2024). Education systems and academic stress – a comparative perspective. *British Educational Research Journal*, *50*(3), 1002–1021. https://doi.org/10.1002/berj.3964

Högberg, B., & Horn, D. (2022). National high-stakes testing, gender, and school stress in Europe: A difference-in-differences analysis. *European Sociological Review*, *38*(6), 975–987. https://doi.org/10.1093/esr/jcac009

Högberg, B., Lindgren, J., Johansson, K., Strandh, M., & Petersen, S. (2021). Consequences of school grading systems on adolescent health: Evidence from a Swedish school reform. *Journal of Education Policy*, *36*(1), 84–106.

Högberg, B., & Strandh, M. (2024). Temporal trends and inequalities in school-related stress in three cohorts in compulsory school in Sweden. *Scandinavian Journal of Educational Research*, *69*(4), 667–681. https://doi.org/10.1080/00313831.2024.2330932

Jackson, C., & Van Houtte, M. (2025). System failure? Exploring the interplay of fear of failure, competition, cooperation and sense of belonging in education in England and Flanders. *British Educational Research Journal*, 1–23. https://doi.org/10.1002/berj.70043

Jagiello, T., Belcher, J., Neelakandan, A., Boyd, K., & Wuthrich, V. M. (2025). Academic stress interventions in high schools: A systematic literature review. *Child Psychiatry and Human Development*, *56*(6), 1836–1869. https://doi.org/10.1007/s10578-024-01667-5

Jerrim, J. (2021). National tests and the wellbeing of primary school pupils: New evidence from the UK. *Assessment in Education: Principles, Policy & Practice*, *28*(5-6), 507–544.

Jung, T., & Wickrama, K. A. S. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass*, *2*(1), 302–317. https://doi.org/10.1111/j.1751-9004.2007.00054.x

Klinger, D. A., Freeman, J. G., Bilz, L., Liiv, K., Ramelow, D., Sebok, S. S., Samdal, O., Dür, W., & Rasmussen, M. (2015). Cross-national trends in perceived school pressure by gender and age from 1994 to 2010. *The European Journal of Public Health*, *25*(suppl 2), 51–56. https://doi.org/10.1093/eurpub/ckv027

Krogh, S. C. (2023). "It's just performance all the time": Early adolescents' accounts of school-related performance demands and well-being. *Scandinavian Journal of Educational Research*, *67*(3), 463–476. https://doi.org/10.1080/00313831.2021.2021446

Låftman, S. B., Almquist, Y. B., & Östberg, V. (2013). Students' accounts of school-performance stress: A qualitative analysis of a high-achieving setting in Stockholm, Sweden. *Journal of Youth Studies*, *16*(7), 932–949. https://doi.org/10.1080/13676261.2013.780126

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Pub. Co.

Lee, M. Y., & Lee, S. M. (2018). The effects of psychological maladjustments on predicting developmental trajectories of academic burnout. *School Psychology International*, *39*(3), 217–233. https://doi.org/10.1177/0143034318766206

Lindblad, F., Backman, L., & Åkerstedt, T. (2008). Immigrant girls perceive less stress. *Acta Paediatrica*, *97*(7), 889–893. https://doi.org/10.1111/j.1651-2227.2008.00857.x

Little, R., Rubin, J., & B, D. (2002). *Statistical analysis with missing data.* (2nd ed.). Wiley.

Liu, X., Zhang, Y., Gao, W., & Cao, X. (2023). Developmental trajectories of depression, anxiety, and stress among college students: A piecewise growth mixture model analysis. *Humanities and Social Sciences Communications*, *10*(1), 736. https://doi.org/10.1057/s41599-023-02252-2

Löfstedt, P., García-Moya, I., Corell, M., Paniagua, C., Samdal, O., Välimaa, R., Lyyra, N., Currie, D., & Rasmussen, M. (2020). School satisfaction and school pressure in the WHO European Region and North America: An analysis of time trends (2002–2018) and patterns of co-occurrence in 32 countries. *Journal of Adolescent Health*, *66*(6), S59–S69. https://doi.org/10.1016/j.jadohealth.2020.03.007

Lundahl, C., Hultén, M., & Tveit, S. (2017a). *Betygssystem i internationell belysning* [Grading systems in an international perspective]. Skolverket.

Lundahl, C., Hultén, M., & Tveit, S. (2017b). 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

Muthén, L. K., & Muthén, B. O. (1998/2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Nylund, K. L., Asparouhov, T., & Muthén, B. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(4), 535–569. https://doi.org/10.1080/10705510701575396

OECD. (2017). *Is too much testing bad for student performance and well-being? PISA in Focus No. 79*. OECD Publishing.

OECD. (2023). *PISA 2022 Technical Report*. OECD Publishing.

Östberg, V., Almquist, Y. B., Folkesson, L., Låftman, S. B., Modin, B., & Lindfors, P. (2015). The complexity of stress in mid-adolescent girls and boys. *Child Indicators Research*, *8*(2), 403–423. https://doi.org/10.1007/s12187-014-9245-7

Parviainen, M., Aunola, K., Torppa, M., Lerkkanen, M.-K., Poikkeus, A.-M., & Vasalampi, K. (2021). Early antecedents of school burnout in upper secondary education: A five year longitudinal study. *Journal of Youth and Adolescence*, *50*(2), 231–245. https://doi.org/10.1007/s10964-020-01331-w

Perming, C., Thurn, Å., Garmy, P., & Einberg, E.-L. (2022). Adolescents' experience of stress: A focus group interview study with 16–19-year-old students during the COVID-19 pandemic. *International Journal of Environmental Research and Public Health*, *19*(15), 9114.

PHAS (Public Health Agency of Sweden). (2018). Varför har den psykiska ohälsan ökat bland barn och unga i Sverige? Utveckling under perioden 1985–2014. Stockholm.

Putwain, D. W. (2009). Assessment and examination stress in key stage 4. *British Educational Research Journal*, *35*, 391–411.

Ram, N., & Grimm, K. J. (2009). Growth mixture modelling: A method for identifying differences in longitudinal change among unobserved groups. *International Journal of Behavioral Development*, *33*(6), 565–576. https://doi.org/10.1177/0165025409343765

Robson, D. A., Johnstone, S. J., Putwain, D. W., & Howard, S. (2023). Test anxiety in primary school children: A 20-year systematic review and meta-analysis. *Journal of School Psychology*, *98*, 39–60. https://doi.org/10.1016/j.jsp.2023.02.003

Røsand, I., & Klomstén, A. T. (2024). Exploring adolescent stress and coping strategies in school: A qualitative study of upper secondary school students in Norway. *Nordisk Tidsskrift for Utdanning og Praksis*, *18*(3), 146–172. https://doi.org/10.23865/up.v18.5975

Sahlberg, P. (2016). The global educational reform movement and its impact on schooling. In K. Mundy, A. Green, B. Lingard, & A. Verger (Eds.), *The handbook of global education policy* (pp. 128–144). John Wiley & Sons.

Salmela-Aro, K., & Upadyaya, K. (2014). Developmental trajectories of school burnout: Evidence from two longitudinal studies. *Learning and Individual Differences*, *36*, 60–68. https://doi.org/10.1016/j.lindif.2014.10.016

Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological Methods*, *7*(2), 147–177. https://doi.org/10.1037/1082-989X.7.2.147

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*(3), 417–453. https://doi.org/10.3102/00346543075003417

Spencer, R., Walsh, J., Liang, B., Mousseau, A. M. D., & Lund, T. J. (2018). Having it all? A qualitative examination of affluent adolescent girls' perceptions of stress and their quests for success. *Journal of Adolescent Research*, *33*(1), 3–33. https://doi.org/10.1177/0743558416670990

Steare, T., Gutiérrez Muñoz, C., Sullivan, A., & Lewis, G. (2023). The association between academic pressure and adolescent mental health problems: A systematic review. *Journal of Affective Disorders*, *339*, 302–317.

Sun, J., Dunne, M. P., Hou, X.-Y., & Xu, A.-Q. (2011). Educational stress scale for adolescents: Development, validity, and reliability with Chinese students. *Journal of Psychoeducational Assessment*, *29*(6), 534–546. https://doi.org/10.1177/0734282910394976

Swedish Government Official Reports. (2019). Jämlikhet i möjligheter och utfall i den svenska skolan (SOU 2019:40).

Swedish Government Official Reports. (2024). Fler vägar till arbetslivet (SOU 2024:74).

Swedish Parliament. (2009). Förslag till riksdagsbeslut om ändring av läroplaner (Prop. 2009/10:219). Retrieved from: https://www.riksdagen.se/sv/dokument-och-lagar/dokument/proposition/betyg-fran-arskurs-6-i-grundskolan_gx03219/html/

Tharaldsen, K. B., Tvedt, M. S., Caravita, S. C. S., & Bru, E. (2023). Academic stress: Links with emotional problems and motivational climate among upper secondary school students. *Scandinavian Journal of Educational Research*, *67*(7), 1137–1150. https://doi.org/10.1080/00313831.2022.2116480

UNESCO. (2012). *International Standard Classification of Education: ISCED 2011*. UNESCO-UIS.

Vansoeterstede, A., Cappe, E., Lichtlé, J., & Boujut, E. (2023). A systematic review of longitudinal changes in school burnout among adolescents: Trajectories, predictors, and outcomes. *Journal of Adolescence*, *95*(2), 224–247. https://doi.org/10.1002/jad.12121

Wetterstrand, F., Sundhäll, M., & Lundahl, C. (2017). Att få sina bedömningar granskade. *Utbildning & Demokrati*, *26*(2), 75–94.

World Health Organization. (2020). Spotlight on adolescent health and well-being. Findings from the 2017/2018 Health Behaviour in School-aged Children (HBSC) survey in Europe and Canada. In *International Report*. Volume 2. *Key data*, 1–139.

Wuthrich, V. M., Jagiello, T., & Azzi, V. (2020). Academic stress in the final years of school: A systematic literature review. *Child Psychiatry & Human Development*, *51*(6), 986–1015. https://doi.org/10.1007/s10578-020-00981-y

Zhao, S., Zhang, Y., Yu, C., Zhang, H., Xie, M., Chen, P., & Lin, D. (2023). Trajectories of perceived stress among students in transition to college: Mindset antecedents and adjustment outcomes. *Journal of Youth and Adolescence*, *52*(9), 1873–1886. https://doi.org/10.1007/s10964-023-01788-5

Zhou, X., Zhen, R., & Wu, X. (2019). Trajectories of academic burnout in adolescents after the Wenchuan earthquake: A latent growth mixture model analysis. *School Psychology International*, *40*(2), 183–199. https://doi.org/10.1177/0143034318810318