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Relative achievement rank, gender and school-related stress: a multilevel study

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ABSTRACT

While academic achievement is often regarded as positive, emerging research has highlighted high levels of stress among high-achieving pupils. However, it remains unclear whether school-related stress is driven by pupils' absolute achievement or by their rank within their peer group. The aim of this study was to examine the association between pupils' achievement rank in class and school-related stress, with a particular focus on gender differences. The study utilised longitudinal survey data from 1691 Swedish pupils, collected in grade 6 (age 13) and grade 9 (age 16), analysed through multilevel and fixed-effects models. There was a positive association between class rank and school-related stress among female pupils, with high-ranking girls exhibiting significantly elevated stress levels also after adjusting for absolute achievement. No association was found among boys. Class rank was not associated with more severe forms of stress or mental health problems. The study suggests that girls may be particularly susceptible to performance pressures and identity formation tied to academic achievement. One interpretation is that there may be a trade-off between short-term stress and long-term educational and labour market success. Schools and educators should acknowledge that high-achieving girls may experience stress despite – or because of – their success.

IMPACT STATEMENT

This study advances understanding of school-related stress by demonstrating that pupils' relative achievement rank within their classroom may matter as much as their absolute academic performance. Using nationally representative longitudinal data from Swedish pupils, the study shows that higher classroom rank is associated with elevated school-related stress among girls, even after accounting for underlying achievement and classroom-level factors. These findings highlight the importance of social comparison processes in shaping pupil well-being and help explain why some of the highest-achieving pupils also report the greatest levels of stress. The work has practical implications for educators and policymakers by suggesting that school environments and assessment practices that emphasise competition and relative standing may have unintended consequences for pupil well-being, particularly among high-achieving girls.

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Introduction

Academic achievement is traditionally regarded as unequivocally positive and desirable. Higher achieving pupils represent the fulfilment of the core mission of institutionalised education, validating the conviction that schooling serves as the primary pathway to social mobility and economic prosperity in modern meritocratic societies. More recently, however, the dark sides of academic success have been increasingly emphasised in research and public discourse alike. High achievements tend to co-occur with excessive

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study hours, sleep deprivation, relinquished friendships, fierce competition and high demands for perfection (Alamillo-Martinez, 2014; Damian et al., 2017; Demerath, 2009; Gaztambide-Fernández, 2010; Liang et al., 2025; Rudolf & Lee, 2023; Spencer et al., 2018; Stentiford et al., 2023; Zhao et al., 2015). Thus, high-achieving pupils, and especially high-achieving girls, have been found to experience disproportionately high rates of school-related stress – understood as a perceived imbalance between academic demands and the resources to cope with them – or otherwise reduced well-being (Eriksen, 2021a, 2021b; Högberg, 2024; Li & Ho, 2024; Luthar et al., 2020; Siebecke, 2026; Tuominen-Soini et al., 2008). This is puzzling from the perspective of established theories of stress (Lazarus & Folkman, 1984), in that these pupils, by virtue of their high achievement, would appear to have the greatest capacity to manage academic demands. A possible clue lies in the distinction between absolute and relative achievement: it may not be a pupil's underlying achievement per se that generates stress, but rather how their achievement ranks relative to that of their peers.

Most research on achievement and stress to date has focused on absolute measures of achievement (Luthar et al., 2020; Tuominen-Soini et al., 2008). However, there are theoretical reasons to expect that relative achievement rank, henceforth referred to as rank for brevity, is related to stress in independent and possibly opposing ways. Unlike absolute achievement, which is strongly correlated with individual characteristics such as cognitive ability, rank is by definition a relational phenomenon. It may therefore be especially consequential for how pupils understand themselves, form their identities and interact with their school environment. Moreover, the importance of rank may be even greater among girls who tend to identify stronger with, and experience higher expectations for, academic success (Krogh, 2023; Røsand & Johansen, 2024; Stentiford et al., 2023). Thus, the aim of this article is to investigate the association between pupils' relative achievement rank and school-related stress, as well as whether this association differs between girls and boys.

To this end, longitudinal survey data on 1691 Swedish pupils aged 16 years were analysed using multilevel and school class fixed effects models. The study makes three key contributions to the existing literature on academic achievement and stress. Theoretically, it provides clues for understanding why the most successful pupils, who have the greatest capacity to manage demands in school, are simultaneously among the most stressed (Alamillo-Martinez, 2014; Eriksen, 2021a; Högberg, 2024). While this may appear paradoxical, it could partly be explained by rank effects. Methodologically, unlike most existing research on rank effects, which due to data limitations has relied on achievement rank within schools (Delaney & Devereux, 2022), this study investigates rank within school *classes*. This is substantively motivated by the premise, rooted in social comparison theory (Festinger, 1954), that classmates constitute pupils' most immediate reference group, making class rank a more theoretically relevant measure. It also has methodological advantages: since pupils and parents often have some influence over which school to attend, but have much less freedom to choose specific classes within schools, class rank is less likely to be confounded by purposeful sorting. In terms of *policy and practice*, the article provides insights into how social comparisons shape pupil well-being: if stress is driven by rank rather than by underlying achievement, it means that individual risks are conditional on the classroom context, and that school practices emphasising comparisons and competition may have unintended consequences.

Background

On the concept of school-related stress

The transactional model of stress and coping (Lazarus & Folkman, 1984) posits that stress arises from a combination of an appraisal of a situation as threatening and a perceived inability to cope with this threat. Stress can thus be seen as an imbalance between demands and resources: appraisals of greater demands (a threat) induce stress, whereas greater resources (perceived coping ability) reduce stress. In a school context, the demands are predominantly related to academic achievement. Accordingly, both qualitative and quantitative research shows that pupils consistently rank the measurement and evaluation of academic achievement such as testing and grading, as well as the consequences of poor achievement for future educational and employment prospects, as the most stressful aspects of the school environment (Banks & Smyth, 2015; Byrne et al., 2007; Denscombe, 2000; Krogh, 2023; Låftman

et al., 2013; Martincová & Bílá, 2023; Östberg et al., 2015; Zhao et al., 2015). Notably, although stress can in principle be conceptualised as a positive feeling related to greater motivation (i.e. eustress; Selye (1975)), qualitative studies show that pupils themselves largely talk about school-related stress in terms of distress, that is, as a negative emotion tied to anxiety, worry and fear (Banks & Smyth, 2015; Putwain, 2009; Røsand & Klomstén, 2024).

Theoretical mechanisms

Existing research on achievement rank and stress is too scarce for specific hypotheses to be deduced. However, it is possible to outline possible and preliminary mechanisms that may generate an association between rank and stress, net of underlying achievement. Before moving to narrower theories that make more specific predictions, a useful general starting point is Festinger's (1954) social comparison theory. The basic premise is that people construct their identities and self-understanding by evaluating themselves against some norm. In the absence of an objective yardstick, this is done through social comparisons, where other people – a relevant reference group – serve as the norm. Such comparisons become more salient the closer one identifies with the reference group in question. For example, secondary pupils are more likely to compare themselves with other pupils of the same age or in the same grade than with university students. Moreover, for social comparisons to work, the achievements or other relevant characteristics of the reference group must be observable. Thus, pupils are more likely to compare themselves with peers in the same school than with all pupils in a country, and more likely to compare themselves with peers in the same school class than with all pupils in the school (Røsand & Johansen, 2024). Thus, social comparison theory predicts that a pupil's rank in class will affect how they view their achievements, as well as their identities and self-understandings more broadly.

In what follows, it should be kept in mind that the mechanisms concern relative rank while holding underlying or absolute achievement constant. Simply put, it is a comparison of two hypothetical pupils with the same underlying achievement (e.g. the same standardised test scores) but where one is enrolled in a relatively high-achieving school or class and the other in a relatively low-achieving school or class. If both pupils have an average underlying achievement, the former will be ranked below average in comparison with their peers while the latter will be ranked above the peer average.

Reasons for a positive association (higher rank → more stress)

There are theoretical reasons to expect that higher ranked pupils experience achievement-related concerns as more threatening, which, according to the transactional model (Lazarus & Folkman, 1984), could generate stress. First, higher-ranked pupils may internalise the role of being a top pupil and incorporate this role into their identity and self-understanding (Cooley, 1902/1983; Låftman et al., 2013). When pupils identify as high achievers, their self-worth may become disproportionately contingent on maintaining high achievement (Covington, 1984), making the risk of suboptimal achievement more threatening (Zhou et al., 2025). Second, higher-ranked pupils may feel pressure to maintain their position at the top of the achievement hierarchy: the higher the rank, the longer the fall and the more they have to lose (Demerath, 2009). They can thus develop a stronger fear of failure, which in turn can generate stress (Jackson, 2010). Third, top-ranked pupils are treated differently by, and face greater expectations from, peers, teachers and parents. They may then feel an externally imposed pressure to constantly prove themselves, both to avoid disappointing other people's expectations and to keep the image other people have of them intact (Zhou et al., 2025). In particular, top-ranked pupils may experience greater socially prescribed perfectionism (i.e. beliefs that others expect perfection of them) in relation to school and achievement (Damian et al., 2017; Neumeister, 2004), which in turn can generate stress (Childs & Stoeber, 2012).

Reasons for a negative association (higher rank → less stress)

There are simultaneously theoretical reasons for expecting that higher ranked pupils have greater perceived capacity to manage and cope with demands in school, which could reduce stress. First, higher

relative achievement is robustly and positively associated with academic self-concept (Marsh, 1987). Greater academic self-concept may make pupils more confident in their ability to succeed academically (Martincová & Bílá, 2023; Murphy & Weinhardt, 2020) and make challenges appear as manageable rather than threatening. Such confidence could, in turn, act as a psychological buffer against stress. Relatedly, the control-value theory of achievement emotions (Pekrun, 2006) posits that perceptions of control over achievement situations (e.g. tests) are essential for avoiding negative achievement emotions. Highly ranked pupils, being accustomed to outperforming their peers, may experience greater control over academic demands more generally, and therefore avoid the stress that is otherwise triggered by excessive demands.

Gender differences

Gender socialisation theory suggests that these mechanisms may operate differentl among girls and boys. First, while boys can gain social status by excelling in multiple arenas, and even by actively disengaging from academic pursuits (Jackson, 2002), social status among girls is more narrowly linked to academic achievement (Krogh, 2023). Moreover, girls are socialised toward more communal roles (Eagly, 1987), roles that may heighten sensitivity to peer comparison and external expectations. Thus, academic success tend to be more central to girls' identities and self-worth (Stentiford et al., 2023; Wigfield & Eccles, 2000), suggesting that the three threat-increasing mechanisms – identity formation, fear of failure and socially prescribed perfectionism – may operate more strongly for girls.

Second, due to gendered stereotypes that associate natural talent with boys, teachers and parents tend to attribute girls' successes to effort or luck rather than to innate ability (Dweck et al., 1978). A high rank may, then, not build academic self-concept in girls to the same extent as in boys, limiting its stress-buffering effect. Likewise, girls tend to perceive lower levels of control despite higher achievements (Pekrun, 2006), suggesting that a high rank may not be enough to foster a sufficient perception of control in achievement situations.

The present study

The aim of this study is to investigate the association between pupils' relative achievement rank in class and school-related stress, as well as whether this association differs between girls and boys. The study contributes to existing research on school-related stress in three ways: by offering a potential explanation for the paradox that the most successful pupils are often among the most stressed; by measuring rank at the class rather than school level and by illuminating how social comparisons shape pupil well-being. As outlined above, there are theoretical reasons to expect that a higher rank both increases the perceived threat of academic demands and strengthens the perceived capacity to cope with them. Given that these counteracting mechanisms make the direction of the net association theoretically ambiguous, as depicted in Figure 1, the study adopts an exploratory approach rather than testing directional hypotheses.

Methods

Data, participants and sampling

Disentangling the role of pupils' rank from that of their underlying or absolute achievement requires (1) data on pupils nested in school classes, with a sufficient number of pupils per class to enable within-class ranking of pupils; (2); data that are simultaneously representative of a meaningful underlying population of pupils (e.g. the national pupil population) to enable estimates of underlying achievement and (3) data on a sufficient number of classes to ensure that rank and underlying achievement are not perfectly collinear. Data from the Evaluation Through Follow-Up (ETF) study satisfy these conditions (Härnqvist, 2000). ETF is a repeated, longitudinal and nationally representative survey of different Swedish pupil cohorts dating back to the 1960s. The present study uses data from the 1998 cohort,

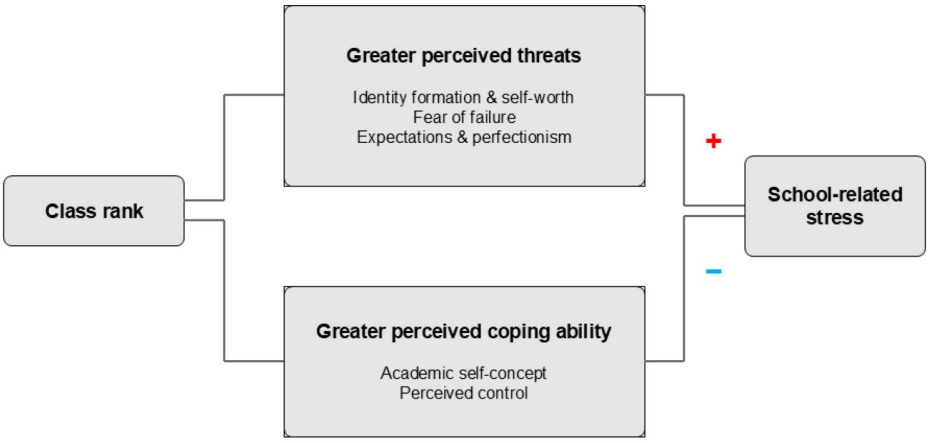

Figure 1. Proposed theoretical pathways linking class rank to school-related stress.

collected when the pupils attended grades 6 (in 2011) and 9 (in 2014) of compulsory school. Data from the recent surveys were not used due to high nonresponse rates.

The data were collected in a two-stage process. First, 300 schools out of 3888 in total in Sweden were selected with selection probability proportional to the number of pupils in the relevant grade. The original sample was drawn based on school attendance in school grade 3 in 2008. Second, all pupils attending the selected schools were surveyed in grades 6 and 9. A total of 8007 pupils (87% of the grade 6 sample) completed the grade 6 survey, 4573 pupils (48% of the grade 9 sample) the grade 9 survey and 3970 pupils both surveys, yielding a 50% attrition rate (University of Gothenburg, 2025). Calibration weights based on data from administrative registers were used to correct for differential non-response rates depending on known demographic characteristics (Statistics Sweden, 2014).

Pupils with missing data on covariates, as well as pupils attending classes with fewer than 10 pupils with data on achievement, were excluded from the analysis. The latter exclusion criterion was necessary to enable meaningful estimates of within-class achievement rank. Since the original sample was drawn based on year 3 school attendance, many pupils had changed school or class by their 9th year, resulting in a final analytical sample consisting of 1691 pupils nested in 262 classes satisfying the inclusion criteria. It should be noted that data on achievement were taken from administrative registers and therefore available for all pupils included in the sample, regardless of whether they responded to the survey or not.

Ethical approval for use of ETF data for this study was granted by the Swedish Ethical Review Authority (reference number: 2024-07679-01).

Outcome: school-related stress

School-related stress was measured by a single indicator, which is the only indicator available in ETF. 'How well do the following statements apply to your situation in school? I experience stress'. Response options ranged from 'Almost never/Never' (1) to 'Always/Almost always (5)'. Multiple-item scales suggest that school-related stress is multidimensional (Byrne et al., 2007). Single-item and global measures like the one available in ETF fail to capture this multidimensionality. Nonetheless, the indicator was deemed fit for purpose for three reasons. First, qualitative research from similar contexts shows that the key term used in the survey, stress, resonates with pupils (Banks & Smyth, 2015; Östberg et al., 2015; Røsand & Klomstén, 2024), supporting the face validity of the indicator. Second, similar global indicators, albeit not focused on school, have been shown to have good reliability and face validity in Swedish adolescent samples (Lindblad et al., 2008; see also Giota and Gustafsson (2017)). Third, the indicator was positively correlated with indexes measuring internalising, and often stress-related, mental health complaints ($r = 0.53$–0.56), indicating criterion validity. A similar global indicator is also included in the Health

Behaviour in School-Aged Children Survey and has been used extensively in research based on these data (Löfstedt et al., 2020).

Exposure: achievement rank

Achievement was measured using data on pupils' subject grades in school grade 9. Swedish pupils are graded in 17 subjects, with the 16 highest subject grades added to an overall grade sum (range 0–320). This grade sum is basically equivalent to a grade point average (GPA) and will henceforth be referred to as such. GPA was only available in grade 9 since pupils in the 1998 cohort were not graded in grade 6. GPA has three important advantages for the purpose of this study. First, it is a high-stakes measure since it is used to sort pupils into schools and programmes in upper secondary school. Thus, unlike for low-stakes achievement tests, pupils have incentives to exert effort to improve their GPA, reducing the risk that achievement is confounded with motivation. Second, grades reflect achievements throughout the school year, meaning that it is less sensitive to the random measurement error inherent in single tests. Third, it is by far the most salient measure of achievement available to Swedish pupils. Since rank effects are, from a theoretical point of view, expected to come about through processes of social comparison, pupils' knowledge of their class rank is key. Importantly, research from other contexts suggest that actual and perceived rank are strongly correlated (Yu, 2020). GPA also has an important drawback, however, in that grades are assigned by teachers and, although guided by national testing and grading criteria, involve a degree of teacher discretion. One consequence of this is that teachers tend to grade on a curve, meaning that it is easier to obtain high grades in a relatively low-achieving class. This does not influence pupils within-class rank, but it does affect the measurement of their underlying achievement (see below).

Pupils' within-class rank was computed in line with existing research on rank effects (Delaney & Devereux, 2022; Denning et al., 2023):

$$\text{class rank} = \frac{(n_{ic} - 1)}{(N_c - 1)}$$

where n_{ic} is the ordinal rank of pupil i in school class c, and N_c is the total number of pupils with data on grades in class c. Thus defined, rank is a continuous measure ranging between 0 and 1, with higher scores indicating higher achievement relative to classmates.

Since class rank is highly correlated with underlying achievement – or differently put, since relative achievement is correlated with absolute achievement – disentangling the effect of class rank requires adjusting for this underlying achievement. While pupils' 'true' underlying achievement cannot be observed directly (Delaney & Devereux, 2022), their GPA relative to the overall pupil population – their national rank – can serve as a proxy (Dadgar, 2024). This is computed in an analogous way as the class rank:

$$\text{national rank} = \frac{(n_{in} - 1)}{(N_n - 1)}$$

where n_{in} is the ordinal rank of pupil i in the national pupil population (specifically those included in ETF, which is designed to be nationally representative), and N_n is the total number of pupils in this population.

An important issue is to what extent class rank varies independently of underlying achievement (i.e. national rank). The correlation between the two is 0.74 in the full data and 0.83 in the analytical sample. While this is high, it is not a perfect correlation and indicates that there are highly ranked pupils with low underlying achievement and vice versa. This is illustrated in more detail in Supplementary file B in the Supplemental online materials. The variation in rank is smallest in the tails of the underlying achievement distribution and larger in the middle. For instance, in the lowest decile of the national achievement distribution, close to half of the pupils are ranked lowest in their class, but a few are also ranked in the upper two thirds. Conversely, the middle four deciles, comprising the 30–70 percentiles of the national achievement distribution, include both pupils that are ranked in the absolute bottom and in the absolute top of their respective classes.

Confounders

While GPA was only available in grade 9, possible confounders were available in both grades 6 and 9. Confounders measured in grade 9 included demographic characteristics and organisational characteristics of the school: factors that may affect, but are unlikely to be affected by, pupils' rank. These included age (in years) and gender, the country of birth (Sweden or other) of the pupil and their parents, the highest educational attainment of either parent, school type (public or private) and teaching practices (teacher-centred, pupil-centred or pupil-dominated). Other confounders could in principle both affect and be affected by rank and were therefore measured in grade 6, that is, before the measurement of achievement. These included indexes of the quality of pupils' relationships with peers as well as with school staff; pupils' leisure time activities (screen time and time spent doing sports), achievement goal orientations (indexes of mastery, performance, social and future-oriented achievement goals), as well as school-related stress in grade 6 to control for baseline levels of stress. They also included pupils' score and class rank on a set of cognitive ability tests taken in grade 6, as well as whether the pupil received special education support in grade 6. In the absence of direct achievement measures such as GPA, these serve as proxies of baseline (grade 6) achievement. Details on the exact measurement of the confounders are provided in Supplementary file A.

Statistical analysis

Key to identifying rank effects is to (1) disentangle rank from underlying achievement, and (2) to block the influence of other confounding factors that are associated with both rank and stress. In addition to the aforementioned included confounders, the main strategy used in this study is inclusion of additive class fixed effects. The class fixed effects account for all factors that are shared by pupils attending the same class (and in extension, the same school), meaning that the estimates of rank effects only rely on within-class variation in both rank and stress. Importantly, this includes purposeful and other non-random sorting of pupils into different classes, school policies and teacher characteristics that affect all pupils in the class, as well as peer characteristics and other contextual effects of the pupil composition (Kiessling & Norris, 2022). The class fixed effects, do not, however, account for class or school factors that have heterogeneous effects depending on achievement (Delaney & Devereux, 2022; Denning et al., 2023). This aspect was explored further in supplementary analyses.

Due to the hierarchical structure of the data, with pupils nested in classes, multilevel linear regression models were estimated, with independent variables added in a stepwise manner.

$$Y_{ic} = \gamma_{00} + \gamma_{10} * C_rank_{ic} + \mu_{0c} + \varepsilon_{ij} \quad \text{(Model 1)}$$

$$Y_{ic} = \gamma_{00} + \gamma_{10} * C_rank_{ic} + \gamma_{20} * N_rank_{ic} + \mu_{0c} + \varepsilon_{ij} \quad \text{(Model 2)}$$

$$Y_{ic} = \gamma_{00} + \gamma_{10} * C_rank_{ic} + \gamma_{20} * N_rank_{ic} + \gamma_{30} * X_{ic} + \gamma_{04} * Z_c + \mu_{0c} + \varepsilon_{ij} \quad \text{(Model 3)}$$

$$Y_{ic} = \gamma_0 + \gamma_1 * C_rank_{ic} + \gamma_2 * N_rank_{ic} + \gamma_3 * X_{ic} + \alpha_c + \varepsilon_{ij} \quad \text{(Model 4)}$$

where Y is school-related stress in pupil i in class c, γ_{00} is the overall intercept and γ_{10} and γ_{20} represent the effects of pupils' class rank (C_rank) and national rank (N_rank), respectively. γ_{30} represents the effects of a vector of individual-level confounders captured by X_{ic}, and γ_{04} the effect of the sole class-level confounder (school type), captured by Z_c. μ_{0c} is the random intercept at the class-level, and ε_{ij} the individual-level error term. Model 4 adds the class fixed effects (α_c) by including indicator variables for each school class. Since these account for all variation at the class level, model 4 drops the random class-level intercept (μ_{0c}) and the class-level confounders (Z_c). Model 4 is thus a single-level ordinary least squares regression model, but with standard errors clustered at the class-level to account for dependence of pupils within classes. Models 1–4 were first fitted on the full sample and then separately for girls and boys. All analyses were conducted using Stata v 18 (StataCorp, 2023).

It should be emphasised that the models are designed to identify the effect of class rank. While estimates for underlying achievement (national rank) are reported for comparison, these are more likely to be biased from unobserved confounding. Moreover, while the class fixed effects, alongside the extensive set of measured confounders, may block many potential confounding factors, fixed effects do not account for reverse causation (Imai & Kim, 2019). Since achievement and stress are measured

Table 1. Summary statistics.

	Mean or percent	Standard deviation	Minimum–maximum
Grade 9 variables			
School-related stress	3.14	1.20	1–5
Class rank	0.54	0.30	0–1
National rank	0.53	0.27	0–1
Gender			
Boy	50.6%		
Girl	49.4%		
Parental education			
Compulsory or unknown	5.4%		
US vocational	22.0%		
US academic	25.7%		
HE 2–3 years	28.8%		
HE > 3 years	18.0%		
Country of birth			
Swedish-born and both parents Swedish-born	76.8%		
Swedish-born and one parent foreign-born	10.5%		
Swedish-born and both parents foreign-born	6.8%		
Foreign-born	5.8%		
Age			
15	1.2%		
16	96.5%		
17	2.3%		
School type			
Public	90.2%		
Independent	9.8%		
Teaching practices			
Teacher-centred	2.49	0.56	1–5
Pupil-centred	3.09	0.62	1–5
Pupil-dominated	2.64	0.50	1–5
Grade 6 variables			
School-related stress	2.37	0.94	1–5
Special education support			
No	89.7%		
Yes	10.3%		
Cognitive ability (score)	21.80	5.60	1–40
Cognitive ability (class rank)	0.49	0.29	0–1
Relationships with peers	4.58	0.57	1–5
Relationships with school staff	4.60	0.60	1–5
Leisure: screen time	3.12	0.65	1–4
Leisure: sports	2.37	0.93	1–4
Achievement goal orientations			
Mastery	4.38	0.60	1–5
Performance	2.87	1.07	1–5
Social responsibility	4.32	0.60	1–5
Future-orientated	4.56	0.61	1–5

This table shows summary statistics on the analytical sample, weighted using calibration weights.

simultaneously, this means that the possibility that stress affects achievement and rank rather than vice versa cannot be ruled out.

Results

Table 1 shows summary statistics for the analytical sample. The majority of pupils had a Swedish background, almost half had at least one tertiary educated parent, about half were girls, and the great majority were aged 16 and attended public schools. The average class and national ranks in the analytical sample were somewhat higher than the average in the total sample (which by construction is 0.5), reflecting the lower response rates of lower achieving pupils. School-related stress was higher in grade 9 than in grade 6.

Pooled results

Figure 2 shows associations between school-related stress and, respectively, class rank and national rank. Complete tables with regression coefficients are presented in Supplementary file C. Model 1 shows bivariate results. Class rank is positively and significantly associated with school-related stress, although the association is weak: moving from the lowest (0) to the highest (1) rank is associated with 0.23 scale

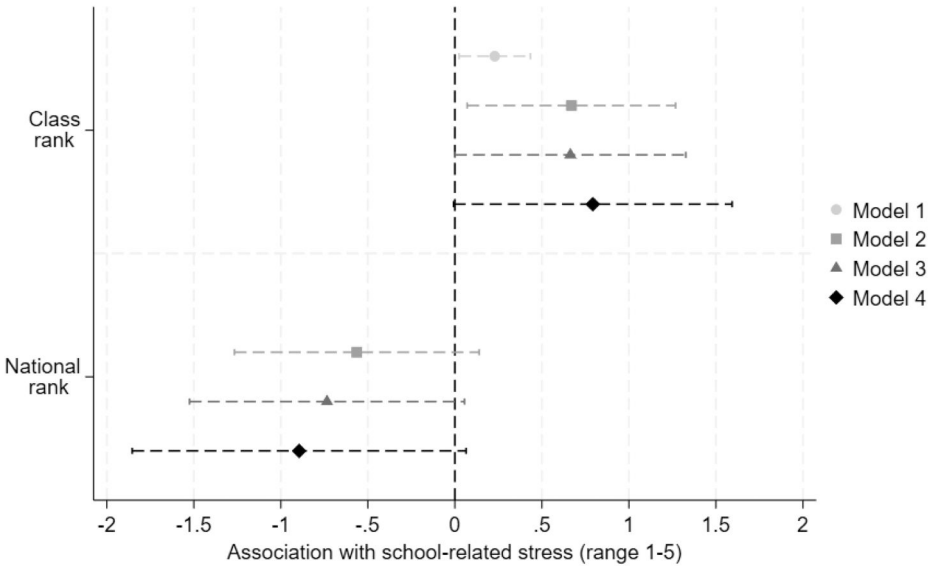

Figure 2. Multilevel linear and ordinary least square regression models with school-related stress in grade 9 as the outcome. Pooled results for both genders.
This figure shows regression coefficients, with 95% confidence intervals. Models 1–3 are multilevel linear models with random intercepts for classes. Model 4 is an ordinary least square regression model with class fixed effects.

points, or 0.19 standard deviations, higher level of stress. Adding national rank (underlying achievement) in model 2 strengthens the association: moving from the lowest to the highest rank is associated with 0.67 scale points, or 0.56 standard deviations, higher levels of stress. This is because national rank is associated with lower stress, thus suppressing the positive association between class rank and stress. The estimates for class rank also become more imprecise, as evidenced by the wider confidence intervals. Model 3 adds the confounders, and model 4 class fixed effects. The influence on the association between class rank and school-related stress is minor, but the estimate becomes non-significant in model 4 due to wider confidence intervals. All in all, results in Figure 2 suggest that class rank may be positively associated with school-related stress, although the association is not robust, in contrast with a corresponding negative but non-significant association between underlying achievement and stress. The variance inflation factor for class rank ranged from 3.57 to 4.29 in models 2 and 3 to a more problematic 12.91 in model 4. However, the point estimates and confidence intervals are largely stable across the models, suggesting that the degree of multicollinearity is not unacceptable.

Gender-stratified results

Figure 3 shows results of the same models fitted separately for girls and boys. Class rank is positively associated with school-related stress in girls after adjustment for national rank, with the association becoming somewhat stronger when in addition adjusting for confounders and class fixed effects. In model 4, moving from the lowest to the highest rank is associated with 1.4 scale points, or more than one standard deviation, higher levels of stress among girls. To illustrate, one scale point is equivalent to the difference between, for instance, 'sometimes' and 'often' experiencing school-related stress. The association between national rank and school-related stress is also significant, and negative, in girls. Among boys, however, neither class rank nor national rank is associated with school-related stress, with the associations being close to zero in all model specifications. In other words, the associations for both genders combined, reported in Figure 2, are fully driven by girls.

Supplementary and sensitivity analyses

Supplementary file D explores the sensitivity of the results to the measurement of achievement and rank. The estimates for class rank become stronger when a more flexible functional form (indicator

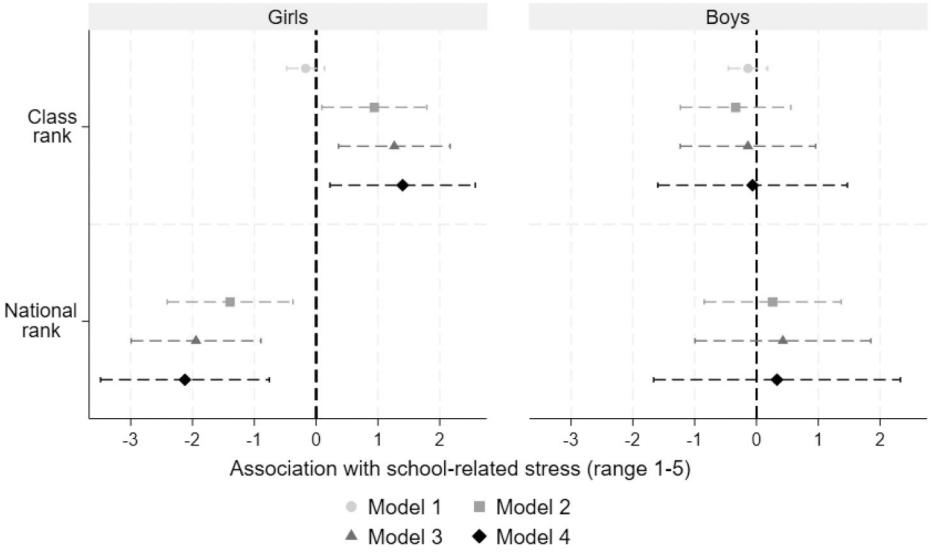

Figure 3. Multilevel linear and ordinary least square regression models with school-related stress in grade 9 as the outcome. Separate results for girls and boys.
This figure shows regression coefficients, with 95% confidence intervals. Models 1–3 are multilevel linear models with random intercepts for classes. Model 4 is an ordinary least square regression model with class fixed effects.

variables for national rank deciles) is used to adjust for underlying achievement. When using absolute GPA instead of national rank, the estimates for both genders combined are similar to the baseline estimates in Figure 2, but the gender differences become smaller. Analyses using a more flexible functional form to measure class rank (indicator variables for class rank quintiles) indicate that the association between class rank and stress is approximately linear, but that the top quintile rank reports disproportionately high levels of stress. Furthermore, there are no interactions between class rank and underlying achievement. Supplementary file E explores heterogeneous effects of peer characteristics by including interactions between underlying achievement and, respectively, class average achievement, share of girls, immigrants and parental education. The estimates for class rank are robust to these additional controls. Supplementary file F shows that class rank is not significantly associated with the most severe form of school-related stress, nor with internalising mental health complaints (which are often stress-related). Supplementary file G explores robustness to additional class characteristics. The estimates for class rank are robust to restricting the sample to schools with at least two classes in the relevant grade level. Since parents have very little influence on the choice of class within a school, this suggests that the results are not driven by purposeful sorting into schools or classes. The point estimates are also largely stable across varying thresholds for minimal class size (5, 10, 15 and 20 pupils), but due to a smaller sample size, the estimates become more imprecise and hence non-significant in models using higher thresholds.

Discussion

Using longitudinal survey data on 1691 Swedish pupils aged 16 years, this article investigated the association between pupils' achievement rank in class and school-related stress, as well as gender differences in this association. Results for both genders combined showed that a higher class rank was generally, but not robustly, associated with higher school-related stress. Models stratified by gender showed that this positive but sometimes non-significant association was a mixture of a strong and consistently significant association among girls and a weak or non-existent association among boys. Put differently, the results for both genders combined were fully driven by girls. The positive association between class rank and stress contrasted with a negative, but largely non-significant, association between underlying achievement (measured by national rank) and stress.

Drawing on the transactional model of stress (Lazarus & Folkman, 1984), the theoretical framework outlined two counteracting mechanisms through which class rank may affect stress: a threat-increasing

mechanism, whereby higher rank raises the stakes of academic success through identity formation, fear of failure and heightened expectations; and a stress-buffering mechanism, whereby higher rank strengthens academic self-concept and perceived control. The finding that higher-ranked girls experience significantly more stress suggests that, for girls, the threat-increasing mechanisms appear to outweigh the buffering ones. The absence of an association among boys is consistent with the two mechanisms cancelling each other out, although it may also reflect that rank is simply less consequential for boys' self-understanding and stress appraisals, in line with research suggesting that girls identify more strongly with academic achievement (Jackson, 2002; Stentiford et al., 2023). Alternatively, boys may respond more positively to competitive and rank-based environments or incentives (Niederle & Vesterlund, 2011). Thus, a higher rank could be experienced as rewarding rather than pressure-inducing, thereby offsetting any threat-increasing effects.

Taken at face value, these results may appear to contradict findings from economics showing generally positive effects of pupil rank on test scores (Murphy & Weinhardt, 2020), educational attainment (Dadgar, 2024; Elsner & Isphording, 2017), earnings (Dadgar, 2024; Denning et al., 2023) and, most notably, mental health (Kiessling & Norris, 2022) later in life. One way to reconcile these apparently discrepant findings is that pupils may regard school-related stress, unpleasant as it may be in the present, as a normal and acceptable price worth paying for subsequent academic and labour market success (Spencer et al., 2018). In other words, viewed from a dynamic life-course perspective, school-related stress may be an integral part of a broader bundle of investments that imposes short-term costs in exchange for a later payoff (Demerath, 2009). As put by Jackson (2010, p. 44), drawing on interviews with British pupils, 'pupils were aware that to be truly 'successful' they had to be able to "handle pressure," to cope with it.' This may also explain the discrepancy with the findings of Kiessling and Norris (2022), showing positive effects of rank on subsequent mental health: if short-term stress has a long-term payoff in terms of better living standards, it may indirectly contribute to better mental health and well-being later in life. In support of this interpretation, class rank was in this study not significantly associated with more severe forms of school-related stress, nor with broader internalising mental health complaints, implying that the association with the continuous stress measure used in the baseline models was driven by a higher rank moving pupils from low to moderate levels of stress. Such moderate levels of stress, in turn, may not involve debilitating levels of anxiety or sleep deprivation that could otherwise impair cognitive functions and learning. On the other hand, even if stress remains moderate at the individual level, the systematically higher burden among girls may also have longer-term costs by shaping coping strategies and career choices in ways that contribute to underrepresentation in competitive or demanding fields such as STEM. It should be also underscored that these interpretations goes beyond what the present data can establish. The study does not include longitudinal follow-up into adulthood, and the possibility that short-term stress, at least for some pupils, translates into long-term benefits remains an open empirical question.

However, while speculative, this interpretation finds some resonance in qualitative research on stress in high-achieving, and especially female, pupils. A key finding in this literature is that stress among high-achieving and academically ambitious girls is linked to both internal and external pressures to *succeed* (Denscombe, 2000; Eriksen, 2021a, 2021b; Krogh, 2023; Låftman et al., 2013; Spencer et al., 2018; Stentiford et al., 2023). Internal pressures involve high performance-related expectations on oneself, often coupled with a performance-based self-esteem, and may be conceptualised as ultimately reflecting an internalisation of the 'ideal pupil'. Pupils construct their identities using their achievements in school as building blocks, and since their beliefs about their achievements are largely based on comparisons with their peers, their achievement rank becomes a salient part of this construction (Denscombe, 2000; Låftman et al., 2013). External pressures involve high standards and expectations from parents and teachers (Denscombe, 2000), expectations that are partly formed based on relative achievements and hence requires the maintenance of one's rank to avoid disappointing them (Jaremus et al., 2025). External expectations also emanate from peer interactions in the form of competition and social comparisons (Spencer et al., 2018). This may generate stress more directly by explicitly directing attention to one's rank in class, with a higher rank implying a longer fall if one fails. For instance, Norwegian adolescents interviewed by Eriksen (2021a, p. 661) report a great 'fear of falling […] of losing status and placement in the social hierarchy'. One pupil describes how 'it's like a competition to get the best grade. … if

I know that he reads that much, then, OK, I have to double that or even a bit more, right. Those who make it, they stress about it' (Eriksen, 2021b, p. 937).

A related interpretation of these results is that it is not necessarily or solely how pupils perform 'objectively' that matters for stress, but also how their performance stands in relation to their expectations and aspirations (Denscombe, 2000). If a higher rank contributes to higher expectations, it may undo any comforting effects of higher 'objective' achievements. This is encapsulated by repeated references to feelings of inadequacy and 'never being good enough' among high-achieving pupils in qualitative studies (Alamillo-Martinez, 2014; Spencer et al., 2018; Walkerdine et al., 2001). As described by an American pupil interviewed in Spencer et al. (2018, p. 22): 'The bar keeps getting raised and raised […] that is definitely a big stress for me […] like not living up to those standards that they have all set for me'.

Importantly, both the internal and external sources of pressure largely gravitate around the same ultimate goal: succeeding academically in order to obtain a good education and job later in life (Denscombe, 2000; Eriksen, 2021a; Jaremus et al., 2025; Spencer et al., 2018). Despite feeling stressed, the pupils interviewed in these studies manage to keep up a high level of achievement relative to their peers, paving the way for future accomplishments.

Limitations

A key limitation of this study is that both achievement and school-related stress were measured in grade 9, meaning that the causal order cannot be determined. While the class fixed effects, alongside the extensive set of measured confounders, may block many potential confounding factors, fixed effects do not account for reverse causation (Imai & Kim, 2019). This means that the possibility that stress affects achievement and rank rather than vice versa cannot be ruled out. Indeed, it seems likely that a modest degree of stress may be beneficial for motivation and effort and thereby boost achievement (Yerkes & Dodson, 1908). Thus, a proper interpretation of the results is that class rank and stress are positively correlated, but one cannot say with any certainty which affects which.

Another limitation is that class rank and underlying achievement are strongly correlated, leaving only limited and possibly idiosyncratic variation in rank after holding underlying achievement constant. Strong intercorrelations among predictor variables may also lead to unstable estimates of regression coefficients. A related limitation is that achievement was measured using teacher-assigned grades. While this has benefits as grades have high stakes for pupils, they are also subject to teacher discretion and a tendency to grade on the curve. This should not affect the measure of class rank, but it does imply that the national rank or the absolute GPA are poorer measures of underlying achievement. Moreover, stress was measured using a single indicator, which may have limited construct validity and cannot capture the multidimensional nature of school-related stress. This may be particularly relevant for interpreting the null findings for severe stress, where a more fine-grained, multi-item measure might have detected associations that the global indicator missed.

Lastly, the results may have limited generalisability. The study is based on Swedish data, and the findings may not generalise to education systems with more pronounced academic competition and explicit ranking practices, such as those in many East Asian countries, where the link between rank and stress may be stronger or operate through different mechanisms. Likewise, since lower-achieving pupils have higher non-response rates, the substantial non-response and attrition rate between survey waves implies that the findings are most informative for pupils in the upper half of the achievement distribution. Moreover, if non-responding lower-achieving pupils are also disproportionately stressed, the positive association between rank and stress may be overestimated.

Conclusions and implications

This study found that a higher achievement rank in class is associated with higher levels of school-related stress among girls but not among boys. However, class rank was not associated with more severe forms of stress or mental health problems. One speculative interpretation is that short-term and moderate levels of stress may serve as a strategic investment that ultimately improves educational and

labour market prospects in the long run, although the elevated stress among girls may also have longer-term costs by reinforcing girls' underrepresentation in competitive or demanding academic fields. The gender disparity in the results, moreover, highlights the gendered nature of academic experiences, consistent with research showing that girls may be particularly susceptible to performance pressures and identity formation tied to academic achievement. These findings should be interpreted in light of the study's limitations, including reliance on a single-item measure of stress and substantial non-response and attrition rates.

These findings have implications for educational policy and practice. Schools and educators should recognise that high-achieving pupils, particularly girls, may experience significant stress despite – or because of – their success. Concretely, schools could review assessment practices that make rank-based comparisons salient, such as public posting of test results or frequent competitive testing, and instead foster feedback cultures that emphasise individual progress over relative standing. Support systems such as mentoring programmes or counselling targeted at high-achieving girls could help address perfectionism, performance-based self-esteem and excessive internal and external expectations.

Future research should employ longitudinal or quasi-experimental designs to better establish the causal direction of the relationship between class rank and stress. Longitudinal data with a longer follow-up would also enable tracking pupils into adulthood to assess whether short-term stress translates into long-term benefits. Additionally, future research should use richer and multi-dimensional stress measures, and investigate possible moderating or mediating factors, such as competitive school climates, parental support and individual personality traits.

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Author contributions

CRediT: **Björn Högberg**: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing – original draft, Writing – review & editing.

Disclosure statement

The author reports that there are no competing interests to declare.

Ethical approval

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Data availability statement

Data from ETF are not publicly available. Please contact the University of Gothenburg for more information.

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