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Received: 26 February 2026 | Accepted: 20 May 2026

DOI: 10.1111/jora.70208

JOURNAL OF Research on Adolescence

EMPIRICAL ARTICLE

Mental health and academic performance in adolescence—Reciprocal links or not?

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Funding information
Swedish Research Council for Health, Working Life and Welfare, Grant/Award Number: 2022-01062; Umeå School of Education, Umeå University, Grant/Award Number: FS 2.1.6-763-24

Abstract

Research shows that academic performance and adolescent mental health are associated, but it remains unclear whether, and in what ways, they reciprocally influence each other over time. This study aimed to examine reciprocal longitudinal associations between academic performance and mental health in adolescence, focusing on internalizing and externalizing problems; and to test whether associations vary across school years or by gender. Self-reported data were obtained from 3473 pupils (48.3% boys) followed annually from grade 7 to grade 9 in Swedish lower secondary school (ages 13–16), with mental health reassessed again in grade 10, the first year of upper secondary school. Academic performance was measured by end-of-year subject grades, and internalizing and externalizing problems were measured with the Strengths and Difficulties Questionnaire (SDQ). We estimated conventional cross-lagged panel models (CLPMs) and random-intercept CLPMs (RI-CLPMs) and used multigroup models to examine gender differences. CLPMs and RI-CLPMs yielded similar substantive conclusions. Externalizing problems showed clear bidirectional within-person links with grades: higher-than-usual externalizing predicted lower subsequent grades, and lower-than-usual grades predicted subsequent increases in externalizing. In contrast, internalizing symptoms showed no within- or between-person associations with grades. Associations did not differ systematically across school years or by gender. We conclude that, across lower secondary school, links between academic performance and mental health are reciprocal yet domain-specific. Behavior appears to be more tightly coupled with grades than mood, indicating that not all facets of mental health, nor all aspects of performance, are equally responsive to one another.

KEYWORDS
academic achievement, adolescence, externalizing problems, internalizing symptoms, mental health, random-intercept cross-lagged model

INTRODUCTION

The association between adolescents' mental health and their academic performance is one of the most replicated findings in developmental and educational research (Amholt et al., 2020; Bücker et al., 2018; Esch et al., 2014; Huang, 2015; Wickersham et al., 2021). Yet it is still not fully clear whether these domains reciprocally influence one another over time and, if they do, what the direction and nature of those effects are as pupils progress through school. Nor is it clear whether observed associations reflect change *within* pupils or stable differences *between* pupils.

Understanding these issues bears directly on how educational processes and pupils' psychosocial functioning are interpreted. Schools shape adolescents' psychosocial well-being through instructional demands, learning environments, and social relations (Wang et al., 2020), while also serving as institutions where performance is continuously assessed and used to sort individuals (Steare et al., 2023). Against a rising concern about adolescent mental health

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(McGorry et al., 2025) and intensified policy emphasis on measurable performance (e.g., OECD, 2013), clarifying the direction of effects between mental health and achievement is increasingly important. In this study, we examine mental health in terms of psychosocial difficulties, focusing on internalizing symptoms and externalizing problems.

Prior research consistently documents cross-sectional and prospective associations across key dimensions of mental health. Higher subjective well-being predicts higher achievement (Amholt et al., 2020; Bücker et al., 2018), higher achievement predicts lower subsequent depression (Huang, 2015), and mental disorders predict poorer attainment (Riglin et al., 2014; Wickersham et al., 2021), while secondary school completion appears protective against later mental health problems (Esch et al., 2014). Similarly, a recent meta-analysis synthesizing longitudinal research on externalizing problems and academic performance reported associations in both directions (Yan et al., 2024; see also Kulkarni et al., 2021). However, much of this evidence cannot determine whether the observed links reflect within-person processes (i.e., whether changes in a pupil's symptoms precede changes in their own performance, or vice versa) or instead reflect stable between-person differences.

A central reason for this uncertainty is methodological: traditional cross-lagged panel models (CLPMs), which dominate the literature, conflate stable between-person differences with within-person fluctuations. Consequently, widely cited conclusions about bidirectional processes may partly reflect methodological artifacts rather than developmental dynamics (Hamaker, 2026; Hamaker et al., 2015; Lucas, 2023). An increasingly used alternative is the random-intercept cross-lagged panel model (RI-CLPM), which separates stable differences between pupils from changes within pupils over time and thus allows us to examine how specific constructs, such as mental health and academic performance, are linked at the within-person level.

This study contributes to this literature in three ways. First, using longitudinal data from pupils in Sweden followed from lower secondary school into the first year of upper secondary school, we use the RI-CLPM (Hamaker et al., 2015) to disentangle within- from between-person associations and provide a more stringent test of reciprocity. Second, we analyze both externalizing and internalizing difficulties, two central dimensions of adolescent mental health. Third, we focus on ages 13–16, spanning the secondary school years, a developmental period that is central to both psychosocial development and educational sorting but remains comparably underrepresented in existing longitudinal work on mental health and academic performance (Yan et al., 2024).

Theoretical perspectives and empirical evidence from cross-lagged within person-models

The longitudinal relationship between psychosocial difficulties and academic achievement is commonly conceptualized within developmental cascade models (Masten & Ciccetti, 2010). These models posit cross-domain carry-over effects in which difficulties in one domain trigger changes in another over time. In school contexts, emotional and behavioral problems may undermine classroom engagement, strain relationships with teachers and peers, and impede academic progress. Conversely, setbacks in school, such as negative evaluations or repeated underperformance, may erode perceived academic competence and self-concept, heighten school-related stress and worry about future opportunities, and expose pupils to social comparison and negative feedback from teachers and peers. Through these pathways, academic difficulties may contribute to internalizing symptoms (e.g., worry, low mood) and, in some cases, to externalizing problems (e.g., frustration and conflict with teachers and peers), which may further disrupt learning and reinforce underachievement, creating self-reinforcing spirals, or "cascades," of academic and psychosocial strain.

Two hypotheses have guided much of the empirical literature on these processes. The *adjustment erosion hypothesis* posits that early psychosocial problems undermine later academic competence, whereas the *academic incompetence hypothesis* suggests that poor academic functioning instigates or aggravates psychosocial problems (Masten et al., 2005; Moilanen et al., 2010). Both perspectives conceptualize development in terms of problem-oriented transactions, wherein difficulties in one domain trigger subsequent difficulties in another. These hypotheses are primarily concerned with problem-oriented transactions, that is, how difficulties in one domain may contribute to later difficulties in another. They are less explicit about whether positive functioning, such as sustained or improving academic performance, may reduce later psychosocial difficulties or operate as a protective factor.

Most prior studies examining these hypotheses in adolescent samples have relied on traditional cross-lagged panel models (CLPMs; e.g., Deighton et al., 2018; Okano et al., 2020; Palmu et al., 2017; Van der Ende et al., 2016). These studies have generally reported support for both adjustment erosion and academic incompetence processes, though findings vary across samples, developmental periods, and mental health outcomes. In theoretical terms, such findings are consistent with developmental cascade models, as they suggest that academic and psychosocial difficulties may contribute to one another over time. However, because CLPMs do not distinguish stable between-person differences from with within-person processes, it remains unclear whether these associations reflect intra-individual developmental transactions or more enduring differences between pupils.

This distinction is important because developmental cascade models are often interpreted as describing within-person processes: that is, whether changes in a pupil's psychosocial functioning are followed by changes in the same pupil's academic performance, or vice versa. More recent approaches, such as the RI-CLPM, address this interpretational issue by isolating within-person fluctuations across

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measurement occasions from stable between-person differences that persist over time (Murayama et al., 2017; Orth et al., 2021). The RI-CLPM, therefore provides a more stringent test of whether the adjustment erosion and academic incompetence hypotheses operate as within-person developmental processes.

Empirically, however, within-person evidence remains scarce. To our knowledge, only two studies have directly examined longitudinal associations between psychosocial difficulties and academic performance in adolescent samples using within-person models, both conducted in Chinese samples. Zhang et al. (2019) followed 648 Chinese pupils from grade 5 to 9, assessing exam performance alongside externalizing and depressive symptoms annually, using both traditional CLPMs and RI-CLPMs. Their findings offered partial support for adjustment erosion processes: externalizing symptoms consistently predicted lower subsequent achievement. Evidence for academic incompetence processes was more limited, as the reverse path, in which higher achievement predicted reduced externalizing symptoms, emerged only from grade 7 and strengthened through grade 9. This suggests developmentally shifting reciprocity (i.e., age-based effects), as the importance of grading increases. For depressive symptoms, however, no within-person reciprocity was found. Moreover, several cross-lagged effects that appeared reciprocal in the CLPM largely disappeared once between-person variance was accounted for in the RI-CLPM.

Similarly, Chen et al. (2022) followed 715 Chinese children from late childhood into early adolescence, examining academic achievement and depressive symptoms across five waves. Using both CLPMs and RI-CLPMs, they found that while the CLPMs suggested reciprocal links, only the negative within-person effects from depressive symptoms to lower subsequent achievement remained significant in the RI-CLPM, with no significant reverse effects. These findings again provide stronger support for adjustment erosion than for academic incompetence processes at the within-person level, particularly when depressive or internalizing symptoms are considered.

Overall, previous studies illustrate both the theoretical plausibility and the empirical uncertainty surrounding reciprocal developmental cascades between psychosocial difficulties and academic performance. While developmental cascade models, the adjustment erosion hypothesis, and the academic incompetence hypothesis all suggest that reciprocal processes are possible, evidence from within-person models indicates that such processes may be domain-specific and less consistently reciprocal than suggested by traditional CLPMs. In particular, existing RI-CLPM findings point to stronger and more consistent effects from psychosocial difficulties to later academic performance than in the reverse direction, especially for depressive or internalizing symptoms, whereas externalizing problems seem to be more closely tied to reciprocal academic processes during adolescence. Thus, the evidence appears partly model-dependent and contextually limited: traditional CLPM studies tend to provide stronger support for reciprocal associations, whereas RI-CLPM studies, conducted in Chinese samples, suggest more limited and domain-specific within-person processes, leaving the direction, domain-specificity, and cross-context generalizability of these links unresolved.

The present study

In this study, we use longitudinal data from Swedish lower secondary schools to examine how psychosocial difficulties and academic performance are linked as pupils move through compulsory school and into upper secondary education. Building on prior studies showing that CLPMs and RI-CLPMs can yield differing conclusions about the magnitude, direction, and even presence of cross-lagged effects (e.g., Núñez-Regueiro et al., 2021; Orth et al., 2021), we estimate both models side by side to provide a stringent test of whether, and in what ways, difficulties and performance co-develop.

Academic performance is operationalized through teacher-assigned grades, introduced nationally from grade 6, which function as a central evaluative mechanism in Sweden's compulsory school (spanning preschool class through grade 9). Grades provide pupils with regular feedback that is comparable across peers, shape pupils' perception of their academic abilities and future prospects (Pinxten et al., 2010), and reflect not only subject-specific competence but also pupils' motivation and capacity to meet the organizational and behavioral expectations of schooling (Bowers, 2011). At the end of grade 9, these grades determine eligibility for upper secondary programs. As such, grades in Swedish lower secondary school constitute a high-stakes institutional signal that may interact with psychosocial functioning in ways that differ from earlier developmental periods.

Specifically, we address three research questions: (1) To what extent are psychosocial difficulties (internalizing symptoms and externalizing problems) and academic performance associated across lower secondary school and the transition to upper secondary education? (2) Do these associations show directional effects over time—that is, do changes in difficulties predict subsequent changes in performance, and do changes in performance predict later psychosocial difficulties—and does the strength of these effects vary across school years? Given that gender is a key axis of social stratification in both adolescent mental health and academic performance, (3) Are these associations comparable for girls and boys?

METHODS

Data and participants

We analyzed data from the longitudinal KUPOL project, a school-based cohort study conducted in Sweden to examine how school environments influence adolescent

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mental health (Galanti et al., 2016). The study targeted public and private schools across eight counties in southern and central Sweden. Of the 541 schools initially contacted, 101 (19%) agreed to participate. A total of 12,512 pupils in grade 7 were invited, of whom 3959 (31.5%) provided informed consent. The cohort comprises two waves of pupil recruitment, carried out during the academic years 2013–2014 and 2014–2015. Data were collected through self-administered questionnaires completed by pupils in the spring semester. The questionnaires assessed a wide range of psychosocial outcomes, health behaviors, and academic functioning.

Of the 3959 pupils who participated in at least one of the four waves, 3473 (87.7%) provided data on at least one wave for both school grades and SDQ scores (internalizing and/or externalizing) and were therefore included in the analytic sample for this study (48.3% boys). Among these, 59.1% had SDQ data at all four waves, 31.9% at three waves, 7.7% at two waves, and 1.3% at a single wave. With regard to school grades, 65.6% provided complete data on school grades across all three waves, 27% at two waves, and 7.4% at one wave.

In the Swedish school system, pupils typically attend grades 7–9 at ages 13–15, followed by the first year of upper secondary education (grade 10) at age 16. Participation was voluntary and based on written informed consent from both pupils and their legal guardians. The KUPOL project was approved by the Swedish Regional Ethical Review Board (ref. 2012/1904–31/1 and 2016/1280–32). Further details on the cohort profile are provided elsewhere (Galanti et al., 2016).

Attrition analysis

Of the 3473 pupils in the analytic sample, 3445 (99.2%) provided SDQ and/or grade data at baseline (grade 7) and thus formed the baseline cohort for the attrition analyses. Among these, 2482 (72.1%) remained at T4 (i.e., provided SDQ data at grade 10).

We conducted a logistic regression analysis predicting attrition from baseline characteristics. The results showed that boys were more likely than girls to drop out (OR = 1.38, $p = .001$). Higher baseline externalizing problems were associated with slightly increased odds of attrition (OR = 1.05, $p < .001$), whereas higher internalizing problems were weakly associated with reduced attrition (OR = 0.96, $p = .024$). Higher academic achievement in grade 7 predicted lower attrition (OR = 0.80, $p < .001$), indicating that pupils with lower grades were somewhat more likely to be lost to follow-up. The model's pseudo R^2 was .03, suggesting that, while attrition was not completely at random with respect to these characteristics, the vast majority in the variability in who remained or dropped out was not explained by these baseline characteristics.

Measures

Academic performance

Academic performance was measured using self-reported end-of-year grades in the three core subjects: mathematics, Swedish, and English. These grades refer to the teacher-assigned subject grades pupils had received, but the information was reported by pupils in the survey rather than obtained directly from teachers or school records. Pupils were asked: "Which grade did you receive in mathematics/Swedish/English when you were in year …?," referring to the previous school year. Hence, the grade variables are retrospective: grades for year 7 were collected in year 8 but represent the cumulative performance achieved during year 7. Similarly, grades for years 8 and 9 were reported during the subsequent school years. Consequently, the dataset includes grade information for three time points: grades from years 7, 8, and 9, reported in years 8, 9, and 10, respectively.

At the time of data collection, the Swedish national grading system ranged from F to A, where F denotes a failing grade (not meeting the minimum knowledge requirements) and A indicates the highest level of achievement. Grades were coded according to the official merit point scale, with F = 0, E = 10, D = 12.5, C = 15, B = 17.5, and A = 20. As a sensitivity check, we re-ran all models using an alternative 1–6 coding, assuming equal intervals between grade levels. This did not alter the results, as the pattern, magnitude, and significance of all parameters were virtually unchanged. To create an overall indicator of academic performance, grades in mathematics, Swedish, and English were averaged at each time point to form a composite mean score. Cronbach's alphas for this three-subject composite were good across waves ($\alpha = .80$ to .84).

Internalizing symptoms and externalizing problems

Pupils completed the Strengths and Difficulties Questionnaire (SDQ; Goodman & Goodman, 2009) annually across the four measurement waves, corresponding to school years 7–10. The SDQ is a widely used 25-item screening tool to assess emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems, and prosocial behavior. The items ask respondents to indicate how well each statement describes their experiences over the past 6 months. In this study, two composite measures were analyzed: *internalizing symptoms*, derived from the emotional symptoms and peer problems subscales, and *externalizing problems*, derived from the conduct problems and hyperactivity/inattention subscales. Both scales range from 0 to 20, with higher scores indicating greater difficulties in each domain. Cronbach's α for the internalizing composite ranged

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TABLE 1 Means, standard deviations, and correlations among study variables.

	M	SD	1	2	3	4	5	6	7	8	9	10	11
1 Gender	1.48	0.50	__										
2 AcaT1	13.92	3.60	−.10***	__									
3 AcaT2	14.44	3.49	−.12***	.81***	__								
4 AcaT3	15.39	3.93	−.12***	.56***	.67***	__							
5 IntT1	4.46	3.21	−.29***	−.04*	−.05**	−.04	__						
6 IntT2	4.74	3.28	−.33***	−.04*	−.05*	−.01	.62***	__					
7 IntT3	5.10	3.39	−.36***	−.02	−.02	.01	.55***	.67***	__				
8 IntT4	4.68	3.22	−.33***	−.01	.00	.01	.54***	.60***	.66***	__			
9 ExtT1	5.21	3.25	−.00	−.23***	−.30***	−.26***	.37***	.26***	.21***	.19***	__		
10 ExtT2	5.21	3.44	.01	−.26***	−.33***	−.27***	.29***	.35***	.27***	.21***	.65***	__	
11 ExtT3	5.31	3.50	−.02	−.24***	−.32***	−.29***	.25***	.27***	.36***	.24***	.57***	.71***	__
12 ExtT4	4.60	3.24	−.04*	−.22***	−.28***	−.26***	.25***	.28***	.27***	.34***	.54***	.62***	.67***

Note: Gender coded 1 = girl, 2 = boy.

Abbreviations: Aca, academic performance; Ext, externalizing problems; Int, internalizing symptoms.

*$p < .05$. **$p < .01$. ***$p < .001$.

from .71 to .73 and for the externalizing composite from .74 to .77.

Data analysis

We estimated random intercept cross-lagged panel models (RI-CLPMs; Hamaker et al., 2015) in Mplus version 8.10 (Muthén & Muthén, 1998–2017). In contrast to traditional CLPMs, the RI-CLPM separates stable between-person differences from within-person fluctuations over time (Hamaker, 2026; Lucas, 2023). This allows us to distinguish two types of processes: (a) whether pupils who typically achieve higher grades also tend to report fewer internalizing and externalizing symptoms than their peers (a trait-like selection or stratification process) and (b) whether year-to-year changes in grades within the same pupil are followed by subsequent changes in symptoms, and vice versa (a dynamic, potentially transactional process unfolding over time).

First, intraclass correlation coefficients (ICCs) were computed to estimate the proportion of variance attributable to between and within-person differences. We then specified separate RI-CLPMs for academic grades and internalizing and externalizing symptoms, respectively. Following Hamaker 2018, each model included two random intercept factors capturing individuals' average level across all measurement occasions. These intercepts represent the between-person level, reflecting stable individual differences, and were allowed to correlate to index the trait-like association between pupils' typical academic performance and typical symptom levels across the study period. At the within-person level, we specified autoregressive paths (i.e., stability paths) for grades and symptoms across waves and bidirectional cross-lagged paths, and within-wave residual covariances between grades and symptoms were freely estimated to account for concurrent co-fluctuations. The cross-lagged paths quantify the extent to which a within-person change in grades at one time point is followed by a change in symptoms at the next time point, and vice versa, after accounting for each process's own stability.

Given our aim to investigate time-specific associations (i.e., whether the strength of these processes varies across school years), we first estimated models in which all autoregressive and cross-lagged paths were freely estimated across time, enabling us to identify whether, for instance, grades in a particular school year were more strongly associated with subsequent psychosocial outcomes, or vice versa. We then tested for developmental changes by comparing these models to versions where corresponding paths were constrained to be equal over time and using Wald tests to formally compare specific cross-lagged parameters (e.g., the effects of grades on externalizing problems across lags).

For comparison, we also estimated CLPMs with the same time structure and cross-lagged pattern but without random intercepts (cf. Zhang et al., 2019). In these models, autoregressive and cross-lagged paths conflate between-person and within-person sources of variation and thus reflect a mix of stable differences between adolescents and dynamic within-person change.

We also fitted multiple-group versions of both the CLPM and RI-CLPM using gender (boys/girls) as the grouping variable to examine whether autoregressive and cross-lagged parameters differed by gender. Gender invariance of specific parameters (e.g., cross-lagged paths and correlations between random intercepts) was evaluated by imposing equality constraints across groups and testing these with Wald tests. Model fit was evaluated using standard fit indices, including the Comparative Fit Index (CFI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). Full

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TABLE 2 Standardized autoregressive and cross-lagged path coefficients for grades and *internalizing* symptoms (full sample).

	Grade7→Grade8		Grade8→Grade9		Grade9→Grade10	
Paths	***β***	**SE**	***β***	**SE**	***β***	**SE**
CLPM						
Aca→Aca	.85***	0.01	.81***	0.01	—	—
Int→Int	.63***	0.01	.68***	0.01	.67***	0.01
Aca→Int	−.02	0.02	.02	0.02	.02	0.02
Int→Aca	−.02	0.01	.03*	0.01	—	—
RI-CLPM model						
Aca→Aca	.66***	0.07	.58***	0.08	—	—
Int→Int	.18***	0.04	.31***	0.04	.30***	0.04
Aca→Int	−.06	0.06	.01	0.05	.08	0.11
Int→Aca	−.03	0.04	.04	0.03	—	—
Between-person						
RI-Aca<–>RI-Int	−0.03 (SE = 0.07)					

Note: Standardized coefficients (β) are reported for all autoregressive and cross-lagged paths. Dashes indicate paths not specified in the model. CLPM model fit: RMSEA = 0.11, CFI = 0.95, TLI = 0.86, SRMR = 0.05. RI-CLPM model fit: RMSEA = 0.011, CFI = 1.00, TLI = 1.00, SRMR = 0.06.

Abbreviations: Aca, academic performance; Int, internalizing problems.

*$p < .05$. **$p < .01$. ***$p < .001$.

information maximum likelihood (FIML) was used to account for missing data (Enders, 2010).

RESULTS

Descriptive statistics

Means, standard deviations, and correlations for the study variables are presented in Table 1. Academic performance had high consecutive-year stability, with strong correlations between waves (e.g., $r = .81$ for grade 7–8 and $r = .67$ for grade 8–9). Internalizing and externalizing also showed moderate to high stability over time ($r = .62$–$.67$ for internalizing and .65–.71 for externalizing). Externalizing problems were consistently and moderately correlated with lower grades ($r = -.23$ to $-.33$), whereas correlations between internalizing and grades were small ($r = \leq .05$). Internalizing and externalizing were moderately correlated within each wave ($r = .26$–$.37$). Gender (1 = girl, 2 = boy) was moderately related to internalizing problems ($r = -.29$ to $-.36$), with higher levels among girls, while boys showed slightly lower mean grades than girls ($r = -.10$ to $-.12$).

The intraclass correlation coefficients (ICCs) indicated the proportion of total variance that was attributable to stable-person differences versus within-person fluctuations over time. For academic performance, the ICC was .61, meaning that 61% of the variance in pupils' grades was due to differences between individuals, while 39% was due to differences within persons across measurement occasions. For internalizing and externalizing symptoms, the ICCs were 0.42 and 0.53, respectively, suggesting that 42% and 53% of the variance was attributable to between-person differences, whereas 58% and 47% were due to differences within persons over time.

Associations between grades and internalizing symptoms

Standardized path coefficients are presented in Table 2. For the CLPM, model fit was mixed overall (RMSEA = 0.11, CFI = 0.95, TLI = 0.86, SRMR = 0.05), but adequate. Autoregressive paths were strong for both grades ($\beta = .80$–$.85$) and internalizing symptoms ($\beta = .63$–$.68$), indicating substantial temporal stability in both domains. In contrast, cross-lagged paths were consistently small and nonsignificant, with only a very weak indication that internalizing problems in grade 8 predicted slightly higher grades in grade 9 ($\beta = .03$, $p = .05$). Overall, the CLPM suggests that the longitudinal association between internalizing symptoms and grades is dominated by within-construct stability rather than "cascade" effects from one domain to the other over time.

Turning to the RI-CLPM for grades and internalizing (RMSEA = 0.01, CFI/TLI = 1.00, SRMR = 0.06), the within-person autoregressive paths were attenuated, as expected, but remained statistically significant. Crucially, however, all within-person cross-lagged paths were small and nonsignificant, and the between-person correlation between the random intercepts for grades and internalizing symptoms was essentially zero ($r = -.03$, $p = .74$). Thus, once between-person differences in typical grade level and typical internalizing symptom level were accounted for, there was no evidence that within-person changes in internalizing symptoms predicted subsequent changes in academic performance, or vice versa.

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Associations between grades and externalizing problems

Standardized path coefficients are presented in Table 3. For the CLPM, model fit was acceptable overall (RMSEA = 0.10, CFI = 0.96, TLI = 0.90, SRMR = 0.04). Autoregressive paths were again strong for both grades (β = .79–.83) and externalizing problems (β = .63–.69). In contrast to the internalizing models, the CLPM revealed clear bidirectional cross-lagged associations: higher externalizing problems predicted lower grades at the next wave (β = −.06 to −.10), and higher grades predicted lower externalizing problems 1 year later (β = −.09 to −.11). These results are consistent with patterns in which both "adjustment erosion" (behavior problems undermining later achievement) and "academic protection" (higher achievement associated with later reductions in problem behaviour) operate over time.

Finally, in the RI-CLPM for grades and externalizing problems (RMSEA = 0.03, CFI/TLI = 1.00, SRMR = 0.01), within-person autoregressive paths were attenuated but remained moderate for grades (β = .59–.44) and externalizing (β = .28–.39). Importantly, the within-person cross-lagged paths remained clearly evident and statistically significant: increases in externalizing problems were followed by declines in grades (β = −.12 to −.21), and higher-than-usual grades predicted reductions in externalizing problems 1 year later (β = −.23 to −.48). Using recently proposed empirical benchmarks (Orth et al., 2024), where β = .03, .07, and .12 are considered small, medium, and large effects, respectively, these cross-lagged effects are thus best characterized as large effects. At the between-person level, the random intercepts for grades and externalizing problems were moderately and negatively correlated (r = −.25, p < .01), indicating that pupils who generally achieved lower grades also tended to have higher levels of externalizing problems (and vice versa).

Although the final grade-to-externalizing path was descriptively larger than earlier waves, Wald tests indicated that differences between corresponding cross-lagged paths across time were not statistically significant (p > .18), providing no clear evidence for strong developmental changes in effect sizes over the school year studied. Taken together, findings point to a robust bidirectional association between academic performance and externalizing problems, at both the within- and between-person levels.

Gender differences

Multigroup CLPMs and RI-CLPMs were estimated to test whether the associations between psychosocial difficulties and grades differed by gender. Wald tests comparing unconstrained models with models in which all autoregressive and cross-lagged paths were constrained to be equal across girls and boys were nonsignificant. Thus, we found no evidence of gender moderation, indicating that, in our data, the longitudinal associations between academic performance and psychosocial difficulties are invariant across gender.

DISCUSSION

Despite a large literature documenting associations between pupils' mental health and their academic performance (Amholt et al., 2020; Bücker et al., 2018; Esch et al., 2014; Huang, 2015; Riglin et al., 2014; Wickersham et al., 2021), convincing evidence on whether, and in what ways, these domains reciprocally influence each other over

TABLE 3 Standardized autoregressive and cross-lagged path coefficients for grades and *externalizing* problems (full sample).

	Grade7 → Grade8		Grade8 → Grade9		Grade9 → Grade10	
Paths	***β***	**SE**	***β***	**SE**	***β***	**SE**
CLPM model						
Aca → Aca	.83***	0.01	.79***	0.02	—	—
Ext → Ext	.63***	0.01	.69***	0.01	.66***	0.02
Aca → Ext	−.11***	0.02	−.09***	0.02	−.11***	0.02
Ext → Aca	−.10***	0.01	−.06***	0.02	—	—
RI-CLPM model						
Aca → Aca	.59***	0.08	.44***	0.11	—	—
Ext → Ext	.30***	0.04	.39***	0.04	.28***	0.05
Aca → Ext	−.21***	0.04	−.22***	0.05	−.48***	0.09
Ext → Aca	−.21***	0.04	−.12**	0.05	—	—
Between-person						
RI-Aca <–> RI-Ext	−0.25 (SE = 0.06)**					

Note: Standardized coefficients (β) are reported for all autoregressive and cross-lagged paths. Dashes indicate paths not specified in the model. CLPM model fit: RMSEA = 0.10, CFI = 0.96, TLI = 0.90, SRMR = 0.04. RI-CLPM model fit: RMSEA = 0.04, CFI = 1.00, TLI = 0.98, SRMR = 0.01.

Abbreviations: Aca, academic perfromance; Ext, externalizing problems.

*p < .05. **p < .01. ***p < .001.

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time remains limited. Longitudinal studies that model bidirectional associations have yielded inconsistent results, with some reporting reciprocal associations and others finding effects only in one direction or no longitudinal links at all (Chen et al., 2022; Deighton et al., 2018; Okano et al., 2020; Palmu et al., 2017; Van der Ende et al., 2016; Yan et al., 2024; Zhang et al., 2019). Part of this inconsistency likely reflects differences in how mental health and performance are operationalized, variation across national and educational contexts, and, as recent methodological work has highlighted, the use of models that do not separate stable between-person differences from within-person change (Hamaker, 2026; Núñez-Regueiro et al., 2021; Orth et al., 2021), thereby raising questions about whether previously reported reciprocal effects truly reflect processes *within* pupils over time. In this study, we therefore examined longitudinal associations between academic performance, operationalized as teacher-assigned subject grades, and two key dimensions of mental health—internalizing symptoms and externalizing problems—using both the traditional CLPM and the RI-CLPM.

A first finding is that the overall pattern of results was highly similar when comparing traditional CLPM with RI-CLPM. Across both modeling approaches, the direction, magnitude, and statistical significance of the cross-lagged paths were largely unchanged. Accordingly, within the Swedish educational context and for these constructs and this time frame, the substantive conclusions do not depend strongly on model choice.

A second central finding is that the associations between psychosocial difficulties and academic performance were clearly domain-specific. Externalizing problems consistently showed clear negative within-person effects on subsequent performance, whereas internalizing symptoms did not. The absence of associations between internalizing and performance (in both directions), at the within-person level and, perhaps more unusually, at the between-person level, is somewhat unexpected, yet not a complete anomaly: Zhang et al. (2019) likewise found no within-person effects between achievement and depressive symptoms (a dimension that conceptually and empirically overlaps considerably with internalizing symptoms) in their sample of Chinese children. A Dutch cross-lagged study by Van der Ende et al. (2016) similarly reported no prospective paths from internalizing problems to academic performance. In line with this pattern, Swedish data suggest that ineligibility for upper secondary school, used as an indicator of poor academic performance, is prospectively linked to externalizing, but not internalizing, problems (Agnafors et al., 2021), and Norwegian data from Evensen et al. (2016) show consistent negative associations between externalizing problems and educational outcomes, but no corresponding links for internalizing problems.

One possible explanation for the nonsignificant association between internalizing and performance in our analyses is that the relationship may be nonlinear: internalizing difficulties might be associated both with very low achievement (e.g., via school absenteeism, withdrawal) and very high achievement (e.g., via perfectionism and overinvestment in schoolwork), with these patterns canceling out in linear models (cf. Högberg, 2024). It is also plausible that internalizing symptoms are linked more closely to other academic outcomes than to grade levels per se (see discussions in Deighton et al., 2018; Masten et al., 2005). Overall, our study adds to the existing body of evidence suggesting that links between externalizing problems and academic performance are stronger, more robust, and more consistently observed than those involving internalizing symptoms.

Our findings, particularly the robust links between externalizing, but not internalizing, and subsequent performance, suggest that "behaviour may matter more than mood" for academic outcomes such as teacher-assigned school grades. This interpretation is consistent with research showing that teachers' evaluations and grading practices are not based solely on pupils' demonstrated subject knowledge (i.e., performance on specific tasks) but also on classroom behavior, engagement, and compliance with school rules (Bloxham et al., 2016; Brookhart et al., 2016; Kunnath, 2017; Malouff & Thorsteinsson, 2016). In this sense, teacher-assigned grades are embedded in a broader "ecology" of evaluation in school, where conformity, self-regulation, and orderly participation are rewarded, while disruptive or oppositional behavior is penalized. In line with the adjustment-erosion hypothesis, our findings imply that behavioral difficulties, for example, being noisy, oppositional, and inattentive, gradually erode pupils' capacity to function in this evaluative ecology and thereby undermine their subsequent performance. Inward-oriented internalizing symptoms, such as sadness or worry, in contrast, are less at odds with behavioral expectations in the classroom and may therefore be less likely to be "punished" in grading.

At the same time, the significant effects from lower-than-usual grades to subsequent increases in externalizing problems are in line with the academic incompetence hypothesis, which posits that poor achievement erodes subsequent psychosocial adjustment. In our data, pupils who received lower grades than usual (compared with the previous year) were more likely to show increases in externalizing problems at the next wave. This pattern, in turn, is consistent with research on self-worth protection (Jackson, 2002; Willis, 1977), which suggests that when pupils experience academic setbacks, they may seek to protect their self-esteem and social status by disengaging from school norms, acting out in class, or adopting oppositional stances toward school. From this perspective, declining grades function as a threatening feedback signal about one's academic competence and social standing; for some pupils, an externalizing response may be a more accessible way of managing this threat than inwardly directed distress. Overall, these bidirectional links suggest that both adjustment erosion and academic-incompetence processes operate, but primarily, or perhaps exclusively, in the domain of externalizing problems rather than internalizing symptoms.

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These domain-specific patterns have implications for how existing theoretical frameworks are formulated. Although much prior work differentiates between internalizing and externalizing difficulties, "mental health" or "psychosocial adjustment" is still often treated as a broad outcome. In particular, formulations of the academic incompetence hypothesis do not typically specify that feedback from academic performance should be channeled differently, or more strongly, into externalizing than internalizing problems. Our findings, however, together with other studies discussed above, point toward a more differentiated picture: across lower secondary school, cascades between academic performance and psychosocial difficulties appear to run mainly through a behavioral channel. A key theoretical implication, therefore, is that developmental models may need to specify which domains of adjustment, or which dimensions of the broader mental health construct, are expected to be involved, not treating "mental health" as a single, homogenous construct that responds uniformly to academic outcomes.

With respect to development change or age effects, our data provide no evidence that the associations varied systematically across the school years studied. We had expected somewhat stronger effects toward the end of lower secondary school, given that grades in year 9 constitute a high-stakes institutional signal in the Swedish system: they determine eligibility for upper secondary programs and are often experienced as particularly consequential by pupils. From this perspective, one could expect that grades in the final year of compulsory school would have a stronger effect on aspects of mental health than earlier grades. Although the cross-lagged path from grades in year 9 to externalizing problems in year 10 was descriptively somewhat larger than the earlier grade-to-externalizing paths, Wald tests indicated that these differences were not statistically significant. Thus, within the time frame covered here (grades 7–10, age 13–16), the reciprocal links between academic performance and externalizing problems appear fairly similar in magnitude across these school years.

Likewise, with respect to gender differences, multigroup models by gender suggested broadly similar results for boys and girls. Our findings thus add to the existing body of research reporting no gender differences in cross-lagged paths or stabilities between boys and girls (e.g., Burt & Roisman, 2010; Chen et al., 2010; Metsäpelto et al., 2015; Van der Ende et al., 2016). Given that gender structures both mental health and academic performance—such that girls typically report higher internalizing symptoms and attain higher grades, whereas boys more often display externalizing problems (Campbell et al., 2021; Voyer & Voyer, 2014)—this may initially seem surprising. However, our findings, together with those of previous studies, suggest that these differences do not translate into systematically different effects. That is, psychosocial difficulties do not appear to undermine grades more strongly for boys than for girls, nor do grades seem to "matter more" for subsequent externalizing problems in one gender than the other. In other words, while boys and girls differ in their average profiles of mental health and academic performance, the reciprocal links between externalizing problems and achievement appear largely comparable across gender.

Limitations

The KUPOL cohort is based on a non-random sample of schools, and both school and pupil response rates at baseline were modest. The low baseline response rate should be understood in relation to the recruitment procedure, which required both school-level participation and pupil/parent consent. Schools that declined participation often reported being already involved in other evaluations or undergoing organizational changes that limited time and resources. Previous descriptions of the KUPOL cohort indicate that participation was selective, with an over-representation of pupils with highly educated parents and an under-representation of pupils with parents outside Sweden (Almroth et al., 2020; Galanti et al., 2016). The sample may therefore be positively selected, with pupils from more socioeconomically advantaged and Swedish-born family backgrounds being overrepresented. Thus, standard caveats about generalizability apply: although the data include substantial variation in school size, location, and sociodemographic composition, the range of school contexts and student background is likely narrower than in the national population. This limitation is particularly relevant for descriptive estimates and generalizability, although the main focus of the present study is on longitudinal within-person associations rather than population prevalence. Moreover, attrition across waves was somewhat higher among boys, pupils with lower grades, and those with more externalizing problems at baseline, implying that estimates may underestimate the strength of associations for the most disadvantaged adolescents. Finally, our measures capture teacher-assigned grades and SDQ-measured symptoms at yearly intervals; other mental health dimensions, and shorter time lags may display somewhat different patterns than those documented here.

CONCLUSION AND IMPLICATIONS

Across lower secondary school, links between mental health and academic performance were reciprocal but domain-specific. We found consistent bidirectional associations between teacher-assigned school grades and externalizing problems, whereas internalizing symptoms showed no association with academic performance, either within or between pupils. These patterns were stable across grades 7–10 (ages 13–16) and largely invariant across gender.

These findings have several implications. For theory, frameworks need to be explicit about which aspect of mental health is expected to be involved in cascades with academic performance. Rather than treating mental health as a unitary outcome, the construct should be differentiated and

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domain-specific pathways specified. For research, the results indicate that different dimensions of mental health ought to be examined separately. For policy and practice, the findings suggest that teacher-assigned subject grades are tied to pupils' behavioral adjustment: academic setbacks and externalizing problems can reinforce each other over time, whereas improving grades alone is unlikely to substantially reduce internalizing symptoms. In the school environment, this means that disruptive or inattentive behaviors should not only be treated as classroom management issues but also as potential indicators of academic vulnerability. Early collaboration between teachers, student health services, and special educational support may therefore help prevent negative cycles in which behavioral difficulties and academic setbacks reinforce one another.

AUTHOR CONTRIBUTIONS

Björn Högberg: Funding acquisition; writing – original draft; writing – review and editing. **Cristian Bortes:** Conceptualization; methodology; investigation; formal analysis; writing – original draft; writing – review and editing.

ACKNOWLEDGMENTS

The authors thank Rosaria Galanti and Filip Andersson for their assistance with providing access to data from the KUPOL study.

FUNDING INFORMATION

This work was supported by the Swedish Research Council for Health, Working Life and Welfare [grant number 2022-01062] and Umeå School of Education, Umeå University [grant number FS 2.1.6-763-24]. The funding sources had no role in study design, data analysis, interpretation of results, or writing of the report.

CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from Karolinska Institutet. Restrictions apply to the availability of these data, which were used under license for this study. Data are available from https://ki.se/en/gph/research-project-kupolknowledge-of-adolescents-mental-health-and-learning-ephir with the permission of Karolinska Institutet.

ETHICS STATEMENT

The KUPOL project was approved by the Swedish Regional Ethical Review Board (ref. 2012/1904–31/1 and 2016/1280–32).

INFORMED CONSENT

Participation was voluntary and based on written informed consent obtained from both the pupils and their legal guardians prior to participation.

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How to cite this article: Bortes, C., & Högberg, B. (2026). Mental health and academic performance in adolescence—Reciprocal links or not? *Journal of Research on Adolescence*, *36*, e70208. https://doi.org/10.1111/jora.70208

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