



Achievement emotions in primary and middle school: the role of sex, age, personality, and emotion regulation

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Abstract

Achievement emotions are influenced by a series of antecedents, but the role of some of them – such as personality traits and emotion regulation (ER) strategies –, particularly in primary and middle school students, remains underexplored. Guided by the Control-Value Theory, this study examined the additive contribution of demographic variables (sex and age), personality traits, and ER strategies to 10 school-related achievement emotions. A sample of 330 fourth, sixth, and seventh-grade students completed measures of Big Five personality traits, two behavioral (Actively Approaching and Withdrawal) and two cognitive (Positive Refocusing and Catastrophizing) ER strategies, and five positive (enjoyment, pride, hope, relief, and relaxation) and five negative (anxiety, anger, shame, hopelessness, and boredom) school-related emotions. Linear mixed models were estimated, with variables entered hierarchically, to assess the additive contribution of each group of factors. Results showed that females reported higher anxiety and lower boredom, while older students reported lower positive and higher negative emotions. Personality traits and ER strategies displayed consistent patterns of associations across emotions: Extraversion, Conscientiousness, Openness, Actively Approaching, and Positive Refocusing were associated with higher positive emotions and lower negative emotions, and vice versa for Neuroticism, Withdrawal, and Catastrophizing. Despite the cross-sectional design, which limits causal interpretations, these findings highlight the role of both stable individual characteristics (sex, age, and personality) and more malleable factors (ER strategies) in students' emotional experiences at school. The results may inform future research and interventions aimed at promoting adaptive ER in educational settings.

Keywords Achievement emotions · School · Demographic variables · Big Five traits · Emotion regulation strategies

Emotions are a fundamental component of educational settings. Students spend a significant amount of their time in school, and their emotional experiences in this context have garnered considerable attention from researchers over the past 25 years (Pekrun,

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2024). The Control-Value Theory of achievement emotions (CVT; Pekrun, 2006, 2024) has given a strong boost to research in this field by providing a theoretical framework for understanding their antecedents and outcomes. However, while the role of some correlates of achievement emotions, such as control-value beliefs and performance, has been amply documented (Camacho-Morles et al., 2021; Luo et al., 2016; Peixoto et al., 2017; Putwain et al., 2021), others have received much less attention. Accordingly, in this study, we investigated the additive contribution of demographic variables (sex and age), Big Five personality traits, and behavioral and cognitive emotion regulation (ER) strategies in shaping primary and middle school students' emotions toward school.

The Control-Value Theory of achievement emotions

According to the CVT (Pekrun, 2006, 2024), achievement emotions are defined as those emotions that students feel in relation to achievement activities (e.g., attending classes, studying, doing homework, or doing written or oral tests) or outcomes (e.g., expecting or receiving a good or bad grade). Beyond their object focus (activity vs. outcome), achievement emotions can also be categorized by valence (positive/pleasant vs. negative/unpleasant) and arousal (activating vs. deactivating). The CVT assumes that achievement emotions impact a range of learning outcomes and, in turn, are influenced by a variety of antecedents. Regarding their outcomes, a meta-analysis corroborated the assumptions that positive activity-related emotions, such as enjoyment, are positively associated with academic performance, whereas negative emotions, such as anger and boredom, are negatively associated (Camacho-Morles et al., 2021). Concerning their antecedents, control-value appraisals are considered proximal, leading to direct changes in emotional experiences. Research confirmed that students perceiving themselves as competent and attributing a positive value to learning tasks generally experience more positive than negative emotions (Luo et al., 2016; Peixoto et al., 2017; Putwain et al., 2021). More distal antecedents are assumed to influence achievement emotions both directly and indirectly through the mediation of control-value beliefs. These include relatively stable individual characteristics, such as sex (or gender, when defined as a social rather than a biological construct; American Psychological Association, 2024) and personality traits (Pekrun, 2006, 2024; Pekrun et al., 2023), as well as more malleable individual dispositions, such as the use of different ER strategies (Harley et al., 2019; Wright et al., 2025).

While the role of these distal factors has been documented in relation to achievement emotions, their relative contribution – particularly when considered simultaneously – has been rarely examined (Sorić et al., 2013), especially in primary and middle school students. Therefore, the present study examines some of the factors considered as distal antecedents in the CVT, namely, sex, personality traits, and ER strategies, within a single analytical framework to estimate their additive contribution to school-related achievement emotions. Moreover, we included age as an additional antecedent, in line with Pekrun's (2024) call for further research on the links posited by CVT, particularly among students attending educational levels lower than high school. Although proximal antecedents (i.e., control-value appraisals) play a central role within the CVT framework, they were not assessed in the present study. Accordingly, our findings should be interpreted as focusing on the contribution of more distal factors, while acknowledging that their associations with achievement emotions may operate both directly and through such proximal processes.

Sex and age differences in achievement emotions

In the CVT (Pekrun, 2006, 2024), the functional associations between achievement emotions and their antecedents and outcomes are considered universal, without assuming differences across sex. However, even though the structure of these relations is assumed to be equivalent, differences in the mean levels of achievement emotions may emerge as a function of differences in their antecedents (primarily, control-value appraisals; Frenzel et al., 2007; Pekrun, 2006) and stereotypes (Bieg et al., 2015).

Previous research involving primary to high school students has amply documented sex differences in subject-related emotions, with girls usually reporting lower positive and higher negative emotions than boys in domains such as mathematics, physics, and physical education, and the opposite pattern in language-related subjects (Fierro-Suero et al., 2023; Frenzel et al., 2007; Lichtenfeld et al., 2012, 2023; Limprecht et al., 2013; Luo et al., 2016; Pekrun et al., 2017; Raccanello et al., 2019; Stipek & Gralinski, 1991; Symes et al., 2025; Wang et al., 2024).

Notwithstanding the assumptions of the CVT about the domain-specificity of achievement emotions and the utility of investigating emotions separately by school subjects (Goetz et al., 2006; Raccanello et al., 2013), in some cases, it is still relevant to examine students' emotions related to the general school domain. This is particularly the case when focusing on trait-level rather than state-level emotions (Pekrun et al., 2011), or when maintaining a comparable level of granularity across constructs to maximize the strength of observed associations (Obermeier et al., 2022). Despite this relevance, relatively little attention has been paid to sex differences in emotions related to the general school context.

Some studies have reported differences in positive emotions. For instance, Gentry et al. (2002) found lower levels of classroom enjoyment in boys than in girls among third to eighth-graders. Similarly, Raccanello et al. (2025) showed that, in seventh grade, mother-reported positive emotions were lower for males than females, whereas no differences emerged among fourth-graders. Findings regarding negative emotions are less consistent. On the one hand, Raccanello et al. (2025) did not find sex differences in a composite measure of school-related negative emotions, neither in fourth nor in seventh-graders. On the other hand, studies focusing on test anxiety have generally reported higher levels in females than males, both in primary school (Aydin, 2019) and in older students (Hoferichter & Raufelder, 2015; Putwain, 2007; Putwain & Daly, 2014). Overall, given the limited and mixed evidence on sex differences in general school-related emotions, further research is needed, particularly in primary and middle school students.

Beyond sex differences, research also explored changes in achievement emotions across diverse ages or school grades. Although the CVT does not assume a specific developmental trajectory (Pekrun, 2024), empirical studies usually report a maladaptive trend, characterized by decreasing positive emotions and increasing negative emotions with age or grade (Lichtenfeld et al., 2023; Raccanello et al., 2013, 2019; Sakaki et al., 2024). Similar patterns have been observed when considering the general school domain, with enjoyment and pride declining, and anxiety, hopelessness, and boredom increasing over time (Gentry et al., 2002; Meyer & Schlesier, 2022; Vierhaus et al., 2016). On the whole, these results suggest a detrimental developmental trajectory in students' emotional experiences, which is in line with the trend observed for other affective or motivational constructs (Bouffard et al., 2001; Hascher et al., 2022; Lepper et al., 2005).

Personality and achievement emotions

Personality can be described as the relatively stable pattern of thoughts, feelings, and behaviors characterizing individuals across different situations and times (Carver & Scheier, 2012; Damian et al., 2019; Shiner et al., 2021). According to the Big Five Model (Goldberg, 1993), personality can be defined by five broad traits, namely Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness. Although originally developed for adults, this model has also proven suitable for younger populations (Vicentini et al., 2025).

A large body of research has documented the association between Big Five traits and well-being in children and adolescents. Higher levels of Extraversion, Agreeableness, Conscientiousness, and Openness, and lower levels of Neuroticism, are generally associated with higher psychological and subjective well-being, both in everyday life (Garcia, 2011; Goswami, 2014; Suldo et al., 2015) and in school contexts (Evans et al., 2018; Weber & Huebner, 2015). Within the CVT framework (Pekrun, 2006, 2024), personality or temperament – referring to emerging personality characteristics in early childhood (McAdams, 2019) – can be conceptualized as distal antecedents of achievement emotions, influencing them both directly and indirectly through control-value appraisals. However, empirical evidence specifically linking personality traits to achievement emotions remains relatively limited, both in samples of adults (for exceptions, Chamorro-Premuzic et al., 2008; de la Fuente et al., 2020, 2024; Pekrun et al., 2023; Sander & de la Fuente, 2022; Thomas & Cassady, 2019; Xu et al., 2024) and in younger populations. In one of the few works focusing on primary and middle school students, Raccanello et al. (2025) found that a composite measure of positive emotions was positively associated with Extraversion, Conscientiousness, and Openness, and negatively associated with Neuroticism, whereas a general measure of negative emotions showed the opposite pattern, with positive associations with Neuroticism and negative associations with Agreeableness and Openness. Studies involving middle and high school students have generally supported these findings (Cheng et al., 2023; Hoferichter & Raufelder, 2015; Hoferichter et al., 2014; Sorić et al., 2013).

Overall, these results suggest that personality traits may play a meaningful role in shaping students' emotional experiences at school, although evidence remains fragmented, particularly with respect to discrete emotions and younger age groups. Further research is therefore needed to better understand how different traits are associated with specific achievement emotions.

Emotion regulation strategies and achievement emotions

ER refers to the processes through which individuals manage which emotions to feel, and when and how to experience or express them (Gross, 1998). These strategies can be broadly categorized into behavioral – involving the process of “taking actions” – or cognitive – pertaining to the process of “thinking” (Garnefski et al., 2001). Although the effectiveness of a given strategy depends on individual and contextual factors (Aldao & Nolen-Hoeksema, 2012; Vaughan-Johnston et al., 2020), some strategies have been generally associated with more or less adaptive outcomes, including psychopathological symptoms (Garnefski & Kraaij, 2018; Garnefski et al., 2007). Accordingly, several authors have proposed distinguishing between typically “adaptive” and “maladaptive” strategies (Garnefski et al., 2007; Putwain et al., 2026; Vierhaus et al., 2016).

In educational contexts, ER strategies can be conceptualized as operating at different stages of the emotion-generative process, as proposed by the ER in Achievement Situations

(ERAS) model (Harley et al., 2019), which integrates Pekrun's (2006, 2024) CVT and Gross's (1998) Process Model of ER. According to this framework, individuals can regulate their emotions at different phases, acting on the situation or their appraisals before emotions arise (in four phases, i.e., situation selection, situation modification, attentional deployment, and cognitive change), or managing their expression after emotions have been generated (in the response modulation phase). Previous research has mainly focused on a limited number of strategies, such as reappraisal and suppression (Frenzel et al., 2024; Sorić et al., 2013), leaving other behavioral and cognitive strategies relatively underexplored. In line with the ERAS framework, the present study focuses on two behavioral (Actively Approaching and Withdrawal; Kraaij & Garnefski, 2019) and two cognitive strategies (Positive Refocusing and Catastrophizing; Garnefski et al., 2007) that can be situated at different points within the emotion-generation process.

Actively Approaching and Withdrawal can be conceptualized as behavioral strategies operating at earlier stages of the process of emotion generation (Kraaij & Garnefski, 2019). Actively Approaching, associated with situation modification, refers to behaviors aimed at actively dealing with stressful events, whereas Withdrawal, linked to situation selection, reflects avoidance of stressful situations and social disengagement. Evidence from adult samples generally characterizes Actively Approaching as more adaptive and Withdrawal as less adaptive (Kraaij & Garnefski, 2019; Şevki Keskiner et al., 2025). Limited evidence in academic contexts suggests similar patterns, with Actively Approaching being associated with more positive emotional outcomes and Withdrawal with less adaptive ones (Mudło-Głagolska & Larionow, 2023).

The cognitive strategies of Positive Refocusing and Catastrophizing can instead be positioned at later stages of the emotion-generative process. Positive Refocusing, related to attentional deployment, involves redirecting thoughts toward more positive – although potentially distracting – aspects of a situation, whereas Catastrophizing, linked to cognitive change, involves emphasizing the negative aspects of an experience. Studies with children and adolescents have shown that Positive Refocusing is generally associated with fewer emotional problems, whereas Catastrophizing is associated with more negative outcomes (Garnefski et al., 2001, 2007, 2017). Although research in educational settings is still limited, available evidence suggests a similar pattern, with Positive Refocusing negatively related to test anxiety and Catastrophizing positively related to test anxiety and other negative emotional outcomes (Putwain et al., 2026; Yang et al., 2022).

However, the role of these strategies in relation to discrete achievement emotions remains insufficiently explored, particularly in primary and middle school students. Given the malleable nature of ER strategies and their potential for intervention (Wright et al., 2025), examining their associations with different achievement emotions represents an important step toward understanding students' emotional experiences in school.

The concurrent influence of demographic characteristics, personality traits, and emotion regulation on achievement emotions

Few works have examined how demographic variables (such as sex and age), personality traits, and ER strategies jointly relate to achievement emotions within the same analytical framework.

Existing studies suggest that these factors may contribute in different ways to students' emotional experiences, although their roles have rarely been examined simultaneously. For example, Sorić et al. (2013), involving high school students, ran hierarchical regressions to

examine the unique contribution of personal variables (gender and age), personality traits, control-value appraisals, and two ER strategies (reappraisal and suppression) in influencing four negative achievement emotions (unhappiness, anger, anxiety, and humiliation) in the context of chemistry learning. Their findings indicated that males and older students experienced more negative emotions; Neuroticism was positively associated with all emotions, while control-value appraisals were negatively associated with them. Moreover, both reappraisal and suppression were positively associated with some negative emotions, with the exception of anger. Similarly, Hoferichter and Raufelder (2015), in a sample of eighth-grade students, found that test anxiety was positively associated with Neuroticism and negatively associated with relationships with peers (which can be interpreted as a proxy for the ER strategy of social support), while also examining gender differences across constructs.

Other authors have examined the role of personality and ER in relation to achievement emotions or school well-being without simultaneously considering demographic variables. For instance, Hoferichter et al. (2014) observed that test anxiety was higher in seventh and eighth-graders high in Neuroticism and with poorer peer relationships, whereas Evans et al. (2018), involving high school students, found that academic productive coping (a strategy similar to problem solving) mediated the associations of Extraversion and Conscientiousness with school satisfaction.

Within the CVT framework (Pekrun, 2006, 2024), these findings can be interpreted as reflecting the influence of antecedents operating at different levels in influencing students' emotions. Demographic characteristics and personality traits can be conceptualized as relatively stable distal antecedents, whereas ER strategies reflect more malleable processes that may shape students' emotional experiences. However, although these factors have been studied individually or in partial combinations, their relative contribution to discrete achievement emotions – particularly when considered within a single analytical framework – remains insufficiently understood.

This gap is especially relevant in primary and middle school students, for whom evidence remains scarce. Therefore, the present study examines how both stable factors (demographic characteristics and personality traits) and more malleable ones (underexplored behavioral and cognitive ER strategies) are associated with a range of school-related achievement emotions within a single analytical framework focusing on their additive contribution.

The current study

This study addresses two significant gaps in the literature: (1) there is a lack of research examining the additive influence of demographic variables, personality traits, and ER strategies on various discrete school-related achievement emotions, particularly among primary and middle school students; and (2) while the importance of ER in educational settings has been widely acknowledged (Harley et al., 2019), most research has predominantly focused on a limited range of strategies (e.g., reappraisal and suppression; Sorić et al., 2013), neglecting other behavioral and cognitive ones. To address these issues and building on the assumptions of the CVT (Pekrun, 2006, 2024), the current study explores the relations between demographic characteristics, the Big Five personality traits, and the use of two behavioral and two cognitive ER strategies in relation to 10 school-related emotions, using a sample of primary and middle school students in Italy. We concentrated on achievement emotions linked to a general domain to maintain a consistent level of granularity in relation to the other measures. Moreover, we recruited students attending the fourth grade of

primary school and the first two years of middle school (sixth and seventh grades). In the Italian educational system, fifth grade marks a transitional year before moving to a higher school level. Due to practical constraints, it is more difficult to obtain permission to access the school in this last year, in which the assessment of students' performance is a particularly salient issue. Therefore, we could not involve fifth-graders.

We had three aims, with corresponding hypotheses formulated as expected patterns of associations. Because the available literature did not allow us to formulate emotion-specific predictions for each of the 10 discrete emotions, these hypotheses were intended as general valence-based expectations, rather than as predictions that each association would necessarily emerge for every single positive or negative emotion.

First, we studied how sex (i.e., defined as the binary categorization assigned at birth; American Psychological Association, 2024) and age were associated with school-related achievement emotions. In line with previous findings (Gentry et al., 2002; Raccanello et al., 2025), we hypothesized that females had higher levels of positive emotions (Hypothesis 1). Given the paucity of works about sex differences in school-related negative emotions (except a few studies using composite measures or focusing on test anxiety; Aydin, 2019; Hoferichter & Raufelder, 2015; Putwain, 2007; Putwain & Daly, 2014; Raccanello et al., 2025), we did not formulate any hypotheses about them. As regards age, based on the maladaptive developmental trend usually documented in the literature (Gentry et al., 2002; Lichtenfeld et al., 2023; Meyer & Schlesier, 2022; Raccanello et al., 2013, 2025; Sakaki et al., 2024; Vierhaus et al., 2016), we expected it to be negatively associated with positive emotions (Hypothesis 2a) and positively associated with negative emotions (Hypothesis 2b).

Second, we examined the association of Big Five personality traits with school-related achievement emotions. Following prior works (Cheng et al., 2023; Hoferichter & Raufelder, 2015; Hoferichter et al., 2014; Raccanello et al., 2025; Sorić et al., 2013), we hypothesized that positive emotions would show positive associations with Extraversion, Agreeableness, Conscientiousness, and Openness, and negative associations with Neuroticism (Hypothesis 3a), and vice versa for negative emotions (Hypothesis 3b).

Third, we investigated how two behavioral and two cognitive ER strategies were linked to school-related achievement emotions. Consistent with previous literature (Mudło-Głagolska & Larionow, 2023; Putwain et al., 2026; Yang et al., 2022), we expected that positive emotions would be positively associated with more adaptive strategies (Actively Approaching and Positive Refocusing), and negatively with more maladaptive ones (Withdrawal and Catastrophizing; Hypothesis 4a), and vice versa for negative emotions (Hypothesis 4b).

Method

Participants

The sample included 330 primary and middle school students attending the fourth ($n = 156$; $M_{age} = 9.69$, $SD = 0.31$, range: 8.97–10.67; 50% females; 11 classes), sixth ($n = 100$; $M_{age} = 11.71$, $SD = 0.45$, range: 11.01–13.45; 52% females; 11 classes), and seventh grade ($n = 74$; $M_{age} = 12.63$, $SD = 0.37$, range: 12.05–14.01; 58% females; 9 classes) in Italy. Five school institutes were involved.

Participants were drawn from diverse socioeconomic backgrounds. Ninety-five percent were born in Italy, as were 69%/71% of their mothers/fathers, respectively. Regarding parental education, 2%/2% of mothers/fathers had no formal qualifications or only primary

education, 11%/13% had completed middle education, 44%/56% high education, and 43%/29% held at least a university degree. With respect to parental occupational status, 16%/3% of mothers/fathers were homemakers, unemployed, on furlough, engaged in civil service, or retired; 82%/97% were employed; and 2%/0% were casual workers.

Procedure

The study was approved by the Ethical Committee of the Department of Human Sciences of the University of Verona (protocol numbers 161865 of 17/04/2023, and 15396 of 08/01/2025). We contacted various schools in Northern Italy, presenting the research project. After obtaining the approval of the heads of the schools, we requested parents or legal guardians to sign the written informed consent form for students' participation. Data collection took place through paper-and-pencil questionnaires administered during regular school classes. We employed a fully guided administration format in which every item was read aloud. This choice was not driven by necessity for all participants, but by the aim of reducing variability linked to individual reading abilities. In particular, presenting the items aloud helped minimize comprehension barriers for students with uneven literacy skills – including those with reading difficulties (e.g., dyslexia; Schiavo et al., 2021) – while promoting more consistent administration conditions across the sample.

Measures

Five traits

We used the *Five-Factor Model – Adolescent Personality Questionnaire* (FFM-APQ; Rogers & Glendon, 2018) to assess the Big Five personality traits, i.e., Extraversion (e.g., “Is very sociable”), Agreeableness (e.g., “Gives things to others”), Conscientiousness (e.g., “Organizes themselves well”), Neuroticism (e.g., “Is easily annoyed”), and Openness (e.g., “Has lots of ideas”). It comprises 25 items – five for each trait – to be assessed on a five-point scale (1 = *Not at all*, 5 = *Very much*).

The FFM-APQ was originally developed in English, so we used back-translation to derive the Italian version (see Table IOR in the Online Resources). Internal consistency, measured through Cronbach's (1951) alpha (α) and McDonald's (1999) omega (ω), was good ($\geq .70$) for all the traits, with the only exception of Agreeableness, slightly below the threshold (Table 1). The five-factor structure of the FFM-APQ was confirmed in this sample and demonstrated measurement invariance across sex and school level at configural, threshold, metric, and scalar levels, based on changes in fit indices within commonly used cut-off criteria (changes in comparative fit index, CFI, $\leq .010$ and in root-mean-square error of approximation, RMSEA, $\leq .015$; see the Online Resources).

Emotion regulation strategies

We assessed four ER strategies. We used eight items of the *Behavioral ER Questionnaire* (BERQ; Kraaij & Garnefski, 2019) to measure Actively Approaching (e.g., “I try to do something about it”) and Withdrawal (e.g., “I avoid other people”), and eight items of the *Cognitive ER Questionnaire* (CERQ; Garnefski et al., 2007) to assess Positive Refocusing

Table 1 Pearson's Intercorrelation, Means (M), 95% Confidence Intervals (CIs), Standard Deviations (SDs), Skewness, Kurtosis, Cronbach's Alpha (α), and McDonald's Omega (ω) for All the Variables

	1	2	3	4	5	6	7	8	9	10	11
1. Enjoyment	-										
2. Pride	.36***	-									
3. Hope	.21***	.27***	-								
4. Relief	.30***	.31***	.40***	-							
5. Relaxation	.38***	.19***	.04	.16**	-						
6. Anxiety	-.17**	-.04	.23***	.03	-.23***	-					
7. Anger	-.30***	-.02	.06	.03	-.24***	.26***	-				
8. Shame	-.01	.01	.06	.13*	-.16**	.10	.18**	-			
9. Hopelessness	-.30***	-.14*	.09	-.07	-.26***	.24***	.42***	.25***	-		
10. Boredom	-.32***	-.07	.03	-.03	-.13*	.20***	.38***	.17**	.19***	-	
11. Sex ^a	.06	-.04	.01	.02	.12*	.13*	-.04	.13*	.10	-.13*	-
12. Age	-.25***	-.13*	.01	-.09	-.19***	.25***	.10	-.05	.09	.19***	.04
13. Extraversion	.30***	.17**	.22***	.14*	.15**	-.05	-.07	-.01	-.07	-.20***	-.06
14. Agreeableness	.16**	.05	.08	.03	.08	.04	-.02	.09	.06	-.16**	.11*
15. Conscientiousness	.23***	.32***	.13*	.21***	.24***	-.06	-.05	-.03	.01	-.19***	-.05
16. Neuroticism	-.11*	-.01	.10	.09	-.12*	.31***	.31***	.27***	.24***	.27***	.09
17. Openness	.24***	.27***	.17**	.18***	.21***	-.04	.01	-.03	.05	-.10	-.03
18. Actively Approaching	.21***	.13*	.10	.13*	.19***	-.08	-.05	-.03	-.06	-.19***	-.18***
19. Withdrawal	-.21***	-.08	-.05	-.02	-.12*	.17**	.20***	.20***	.31***	.13*	.08
20. Positive Refocusing	.31***	.25***	.20***	.17**	.24***	-.16**	-.07	-.07	-.15**	-.09	.07
21. Catastrophizing	-.06	.03	.09	.03	.04	.22***	.13*	.06	.26***	.06	.01
M	3.82	2.95	3.04	2.91	3.60	3.03	2.36	1.95	2.07	2.74	0.52
95% CI	[3.69, 3.95]	[2.81, 3.10]	[2.90, 3.18]	[2.77, 3.05]	[3.46, 3.73]	[2.87, 3.18]	[2.23, 2.49]	[1.82, 2.08]	[1.94, 2.19]	[2.61, 2.86]	[0.47, 0.58]
SD	1.19	1.32	1.30	1.28	1.23	1.42	1.23	1.21	1.16	1.17	0.50

Table 1 (continued)

	1	2	3	4	5	6	7	8	9	10	11
Skewness	-0.72	-0.03	-0.05	0.16	-0.50	-0.01	0.62	1.21	0.91	0.23	-0.09
Kurtosis	-0.48	-1.04	-1.07	-1.04	-0.75	-1.32	-0.60	0.45	-0.08	-0.81	-2.01
α	-	-	-	-	-	-	-	-	-	-	-
ω	-	-	-	-	-	-	-	-	-	-	-
1. Enjoyment	11	12	13	14	15	16	17	18	19	20	21
2. Pride											
3. Hope											
4. Relief											
5. Relaxation											
6. Anxiety											
7. Anger											
8. Shame											
9. Hopelessness											
10. Boredom											
11. Sex ^a	-										
12. Age	.04	-									
13. Extraversion	-.06	-.09	-								
14. Agreeableness	.11*	.02	.40***	-							
15. Conscientiousness	-.05	-.14**	.44***	.31***	-						
16. Neuroticism	.09	.14*	-.02	.05	-.15**	-					
17. Openness	-.03	-.21***	.54***	.31***	.50***	.07	-				
18. Actively Approaching	-.18***	-.13*	.30***	.25***	.36***	-.08	.21***	-			
19. Withdrawal	.08	-.08	-.16**	-.01	-.11*	.35***	-.05	-.25***	-		

Table 1 (continued)

	11	12	13	14	15	16	17	18	19	20	21
20. Positive Refocusing	.07	-.17**	.24***	.04	.24***	-.06	.18**	.21***	-.21***	-	-
21. Catastrophizing	.01	-.06	.03	.07	.02	.23***	.15**	.01	.24***	-.11*	-
<i>M</i>	0.52	10.96	3.40	3.43	3.31	2.73	3.59	3.17	2.34	3.15	2.65
95% <i>CI</i>	[0.47, 0.58]	[10.82, 11.10]	[3.31, 3.49]	[3.35, 3.52]	[3.22, 3.40]	[2.63, 2.84]	[3.50, 3.68]	[3.07, 3.27]	[2.23, 2.45]	[3.02, 3.28]	[2.55, 2.75]
<i>SD</i>	0.50	1.30	0.85	0.77	0.85	0.96	0.83	0.92	1.00	1.20	0.96
Skewness	-0.09	0.17	-0.37	-0.13	-0.08	0.25	-0.31	0.01	0.63	-0.17	0.20
Kurtosis	-2.01	-1.45	-0.25	-0.11	-0.32	-0.44	-0.38	-0.67	-0.39	-1.03	-0.75
α	-	-	0.71	0.69	0.74	0.77	0.73	0.73	0.73	0.87	0.71
ω	-	-	0.71	0.68	0.74	0.78	0.72	0.72	0.73	0.87	0.70

^aSex was coded using 0 for males and 1 for females. * $p < .05$. ** $p < .01$. *** $p < .001$

(e.g., “I think of nicer things than what I have experienced”) and Catastrophizing (e.g., “I keep thinking about how terrible it is what I have experienced”). Each item was rated on a five-point scale (1 = *Not at all*, 5 = *Extremely*). These instruments assessed ER strategies as general tendencies used to cope with stressful situations in everyday life, rather than as strategies specifically enacted in school-related situations. Although this difference in contextual specificity may have attenuated the associations with school-related achievement emotions, this choice was consistent with our broader rationale of moving from relatively general individual characteristics and regulatory tendencies to students’ emotional experiences in a specific achievement context. For the BERQ, we translated the items in Italian through back-translation (Table 10R). For the CERQ, we used the validated Italian version (Cerolini et al., 2022; Presaghi & Ercolani, 2005). The internal consistency of both scales was good (Table 1), their factorial structure was confirmed, and measurement invariance across sex and school level was supported at configural, threshold, metric, and scalar levels, based on changes in fit indices within commonly used cut-off criteria (changes in CFI $\leq .010$ and RMSEA $\leq .015$; see the Online Resources).

Achievement emotions

We measured school-related achievement emotions by using the *Drawing Set for the Achievement Emotions Adjective List* (DS-AEAL; Raccanello & Burro, 2024), specifically developed to enhance children’s comprehension of the brief version of the AEAL (Raccanello et al., 2022) through the integration of pictorial representations. The short single-item version of the AEAL has been previously used in studies involving both primary school children and adult samples (e.g., Raccanello et al., 2013, 2024), providing initial support for its applicability across age groups and contexts. The DS-AEAL consisted of 10 single items measuring three positive activating (i.e., “Happy”, “Hopeful”, and “Proud”), two positive deactivating (i.e., “Relieved” and “Calm”), three negative activating (i.e., “Anxious”, “Angry”, and “Ashamed”), and two negative deactivating emotions (i.e., “Sad” and “Bored”). Each item comprised a verbal label describing the emotion and a drawing of the associated facial expression. The sex of the children represented in the images was matched with the participants’ sex to favor identification. Despite being aware of the limitations associated with single-item compared to multi-item measures, we used this approach, in line with previous studies (Goetz et al., 2010; Nett et al., 2011), in order to keep the questionnaire brief (also considering the reduced attention span of younger children; Simon et al., 2023). In addition, when assessing emotional states, single-item measures may reduce the risk of recall bias associated with longer instruments requiring participants more time for reflection (Goetz et al., 2010). However, this measurement choice necessarily limited the psychometric evaluation of the outcome variables, as internal consistency and structural validity could not be estimated for single-item indicators.

Data analysis

We used R (version 4.5.3; R Core Team, 2026) to conduct 10 linear mixed models (LMMs), one for each emotion, included as the outcome variable. In each model, variables were entered hierarchically in three steps to examine the additive contribution of different sets of predictors, based on theoretical reasons (CVT; Pekrun, 2006, 2024), previous research (Sorić et al., 2013), and a stability/malleability criterion (from the most stable to the most malleable antecedents). This approach allowed us to assess the unique and combined

contribution of demographic variables, personality traits, and ER strategies. Although more complex analytical strategies (e.g., path analyses or structural equation modeling) could allow for a more integrated examination of the relations among variables, such approaches were not feasible given the limited sample size relative to model complexity (Kline, 2023). For each LMM, we included as fixed effects: demographic variables (sex and age – as sex was categorical, it was coded as a dummy variable: 0 = *males* and 1 = *females*) in step 1; Big Five personality traits (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness) in step 2; and behavioral (Actively Approaching and Withdrawal) and cognitive (Positive Refocusing and Catastrophizing) ER strategies in step 3. Following Keith (2019), the size of the relations was considered small with $.05 < \beta \leq .10$, medium with $.10 < \beta \leq .25$, and large with $\beta > .25$. However, these thresholds should be interpreted with caution, particularly for values close to the cut-off points. Given the cross-sectional nature of the data, the analyses were intended to examine associations among variables rather than directional or causal relations. In addition, to account for multiple testing and the associated risk of Type I error, we conducted sensitivity analyses by applying a false discovery rate (FDR) correction using the Benjamini–Hochberg (BH) procedure (Benjamini & Hochberg, 1995). For each association, both raw and BH-corrected *p*-values were computed to account for the increased likelihood of false positive findings due to multiple comparisons.

Considering the nested structure of the data (students within classes and schools), intra-class correlation coefficients (ICCs) were computed for both predictor and outcome variables to assess potential clustering effects. ICCs indicated negligible clustering at the school level (.00–.05) and small to moderate clustering at the class level (.01–.12; LeBreton & Senter, 2008). Based on these results, class was included as a random effect in the models.

Model performance was evaluated using different criteria. The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to assess model fit, with lower values indicating better fit. Changes in AIC (Δ AIC) were considered to compare consecutive steps: Δ AIC < 0 indicates improved fit of the more complex model, whereas $0 \leq \Delta$ AIC ≤ 4 indicates comparable models, $4 < \Delta$ AIC ≤ 7 suggests moderate evidence against the more complex model, and values > 7 indicates a substantially worse fit (Burnham & Anderson, 2004). Marginal and conditional R^2 were used to quantify explained variance, considering fixed effects only and both fixed and random effects, respectively. Root mean square error (RMSE) was used to assess the overall prediction error of the models. Finally, likelihood ratio tests were used to determine whether the inclusion of additional sets of variables resulted in significant improvements in model fit across steps.

Before conducting the LMMs, we performed Pearson's intercorrelations, descriptive statistics, and preliminary analyses to evaluate key model assumptions. Specifically, we conducted Kolmogorov–Smirnov, dispersion, outliers, singularity, multicollinearity, and random variance tests (Hartig, 2024).

Across all participants, 0.29% ($n = 51$) of the data was missing. Little's (1988) test was non-significant, $\chi^2(1716) = 1805.48$, $p = .065$, indicating that data were missing completely at random (MCAR). Missing values were replaced using available-item scoring. Specifically, scale scores were computed as the mean of the available items within each scale. This approach was preferred over listwise deletion, as excluding all participants with at least one missing response would have resulted in the unnecessary loss of otherwise valid data, despite the fact that missingness was limited to a single item per incomplete participant. Given the very low proportion of missing data, this approach was considered appropriate and unlikely to meaningfully bias the results (Buczak et al., 2023).

For the final models (step 3), we estimated approximate global model power ($\alpha = .05$) using marginal R^2 , converted to Cohen's f^2 , with the effective sample size adjusted for

clustering using the ICC. Estimated power values ranged from .88 to 1.00, suggesting adequate power to detect the overall fixed-effect structure of the models.

The R packages and functions used for the main analyses are reported in the Online Resources.

Results

Preliminary analyses

Before running the 10 LMMs, we conducted preliminary analyses. Pearson's intercorrelations and descriptive statistics for all variables – including means, 95% confidence intervals (CIs), standard deviations, skewness, kurtosis, Cronbach's (1951) α , and McDonald's (1999) ω – are reported in Table 1.

First, we examined the normality of the distributions. Skewness and kurtosis values ranged between -2 and $+2$ (with the exception of sex; see Table 1), indicating approximately normal distributions (George & Mallery, 2016).

Second, we evaluated model assumptions for LMMs. Kolmogorov–Smirnov tests on the distribution of simulated residuals indicated that model assumptions were generally met ($ps > .05$), although some deviations from the expected distribution were observed for anger, shame, and hopelessness. Dispersion tests showed that the observed variability was consistent with that expected under the models (all $ps > .05$). Outliers tests did not reveal the presence of influential or extreme observations (all $ps > .05$). Singularity tests confirmed that the models were not overparameterized. Multicollinearity was low (all variance inflation factor, VIF, values < 2 ; Shrestha, 2020), indicating no problematic correlations among variables. Finally, random variance estimates indicated that random effects contributed to the models, although their magnitude varied across outcomes.

Linear mixed models

Statistics and standardized coefficients (β) of the 10 LMMs are reported in Table 2, Table 3, and Table 4. The 95% CIs associated with β s are reported in Table 3OR. Unstandardized coefficients (B) and associated standard error (SE) are reported in Table 4OR.

Positive emotions

Demographic variables (step 1) explained limited variance in positive emotions, as reflected in relatively low marginal R^2 values across outcomes (Table 2). The inclusion of personality traits (step 2) substantially improved model fit for all positive emotions, as indicated by decreases in AIC and significant model comparisons (all $ps \leq .001$), as well as increases in marginal R^2 . The addition of ER strategies (step 3) further improved model fit for enjoyment, pride, hope, and relaxation, as reflected in additional reductions in AIC and significant model comparisons ($p < .05$), whereas no significant improvement was observed for relief. Marginal R^2 values increased across steps, indicating that the inclusion of personality traits and ER strategies contributed to explaining variance in positive emotions. Conditional R^2 values were generally higher than marginal R^2 values, indicating the additional contribution of random effects, although they were comparable in some cases, particularly in step 3 for enjoyment and step 1 for relief (Table 2).

Table 2 Model Fit and Comparison Indices for the Three-Step (Hierarchical) Linear Mixed Models for the 10 Emotions

		AIC	Δ AIC	BIC	R^2_m	R^2_c	RMSE	p
Enjoyment	Step 1	1033.25	-	1052.22	.07	.10	1.12	-
	Step 2	1008.69	-24.54	1046.68	.16	.18	1.07	< .001
	Step 3	992.97	-15.72	1046.16	.22	-	1.04	.029
Pride	Step 1	1119.72	-	1138.72	.02	.07	1.26	-
	Step 2	1090.83	-28.90	1128.82	.13	.17	1.19	< .001
	Step 3	1088.00	-2.83	1141.19	.16	.20	1.17	.029
Hope	Step 1	1114.25	-	1133.25	.01	.05	1.25	-
	Step 2	1102.56	-11.69	1140.55	.06	.11	1.21	< .001
	Step 3	1097.64	-4.92	1150.83	.10	.16	1.17	.012
Relief	Step 1	1105.32	-	1124.30	.01	-	1.28	-
	Step 2	1093.41	-11.91	1131.37	.07	.08	1.24	< .001
	Step 3	1096.63	3.21	1149.78	.09	.09	1.22	.311
Relaxation	Step 1	1062.91	-	1081.90	.05	.12	1.13	-
	Step 2	1053.14	-9.77	1091.13	.10	.18	1.10	.001
	Step 3	1046.76	-6.38	1099.95	.14	.21	1.07	.006
Anxiety	Step 1	1151.29	-	1170.28	.08	.08	1.36	-
	Step 2	1134.07	-17.22	1172.06	.15	-	1.31	< .001
	Step 3	1126.07	-8.00	1179.26	.19	-	1.28	.003
Anger	Step 1	1074.64	-	1093.62	.01	.06	1.18	-
	Step 2	1050.78	-23.86	1088.74	.11	.14	1.13	< .001
	Step 3	1054.28	3.50	1107.42	.12	.16	1.12	.342
Shame	Step 1	1063.81	-	1082.81	.02	.06	1.15	-
	Step 2	1043.13	-20.68	1081.12	.10	.15	1.10	< .001
	Step 3	1047.21	4.08	1100.30	.12	.16	1.10	.417
Hopelessness	Step 1	1038.83	-	1057.83	.02	.06	1.11	-
	Step 2	1025.63	-13.21	1063.62	.08	.12	1.07	< .001
	Step 3	998.29	-27.34	1051.48	.17	.23	1.00	< .001
Boredom	Step 1	1023.87	-	1042.86	.06	.13	1.07	-
	Step 2	993.23	-30.64	1031.22	.17	.22	1.01	< .001
	Step 3	995.73	2.50	1048.92	.18	.23	1.00	.240

AIC Akaike information criterion, Δ AIC changes in AIC, BIC Bayesian information criterion, R^2_m marginal explained variance, R^2_c conditional explained variance, RMSE root mean square error. In the column reporting R^2_c , a dash (“-”) indicates that the inclusion of the clustering variable (class) did not increase explained variance

The following results refer to step 3 of the analyses (Table 3), which was used as the final model for all outcomes for consistency – even for relief, for which the inclusion of ER strategies did not significantly improve model fit. In the text, we present associations that reached significance before correction, and in the final summary we identify those that did not remain significant after the BH correction and should thus be interpreted with caution.

Demographic variables No significant associations emerged for sex. Age showed a medium negative association with enjoyment ($\beta = -.20$, $p < .001$).

Table 3 Standardized Coefficients (β), Standard Errors (SE), Chi-Squared Statistics With Associated Degrees of Freedom, and Raw and Benjamini–Hochberg (BH) Corrected p -Values for the Final Models Examining Associations With Positive Emotions. Significant p -Values Are Reported in Bold

	Enjoyment			Pride			Hope			
	β	SE	χ^2 (df)	p_{raw}/p_{BH}	β	SE	χ^2 (df)	p_{raw}/p_{BH}	β	SE
Step 1										
Sex ^a	.06	.05	1.45(1)	.228/.380	-.05	.05	0.75(1)	.387/.484	.01	.06
Age	-.26	.06	16.99(1)	< .001/< .001	-.15	.07	4.09(1)	.043/.086	-.01	.07
Step 2										
Sex ^a	.09	.05	2.70(1)	.100/.200	-.03	.05	0.25(1)	.618/.687	.01	.05
Age	-.21	.06	12.30(1)	< .001/.002	-.07	.07	1.22(1)	.270/.449	.02	.07
Extraversion	.21	.07	10.93(1)	< .001/.010	-.01	.07	0.01(1)	.979/.981	.20	.07
Agreeableness	.04	.06	0.39(1)	.530/.724	-.07	.06	1.33(1)	.248/.620	-.04	.06
Conscientiousness	.07	.06	1.37(1)	.242/.403	.26	.06	16.40(1)	< .001/< .001	.06	.07
Neuroticism	-.07	.05	1.90(1)	.169/.187	.04	.05	0.51(1)	.477/.477	.10	.06
Openness	.04	.07	0.33(1)	.564/.806	.15	.07	4.75(1)	.029/.293	.03	.07
Step 3										
Sex ^a	.08	.05	2.66(1)	.103/.174	-.04	.05	0.69(1)	.407/.509	-.01	.06
Age	-.20	.06	13.59(1)	< .001/.001	-.05	.07	0.66(1)	.418/.523	.04	.07
Extraversion	.15	.06	5.77(1)	.016/.097	-.04	.07	0.31(1)	.577/.700	.16	.07
Agreeableness	.05	.06	0.83(1)	.361/.855	-.05	.06	0.61(1)	.437/.855	-.02	.06
Conscientiousness	.03	.06	0.22(1)	.640/.711	.23	.07	12.57(1)	< .001/.004	.03	.07
Neuroticism	-.02	.06	0.09(1)	.761/.761	.05	.06	0.70(1)	.404/.449	.10	.06
Openness	.04	.07	0.40(1)	.529/.812	.14	.07	4.45(1)	.035/.349	.02	.07
Actively Approaching	.05	.06	0.73(1)	.391/.984	-.01	.06	0.04(1)	.851/.984	.01	.06
Withdrawal	-.14	.06	6.00(1)	.014/.072	-.05	.06	0.57(1)	.452/.679	-.04	.06
Positive Refocusing	.17	.05	9.26(1)	.002/.008	.17	.06	8.97(1)	.003/.008	.19	.06
Catastrophizing	-.03	.05	0.30(1)	.582/.831	.03	.06	0.39(1)	.532/.832	.09	.06

Table 3 (continued)

Hope	Relief		Relaxation	
	$\chi^2(df)$	p_{av}/p_{BH}	β	SE
Step 1				
Step 2				
Step 3				

^aSex was coded using 0 for males and 1 for females

Table 4 Standardized Coefficients (β), Standard Errors (SE), Chi-Squared Statistics With Associated Degrees of Freedom, and Raw and Benjamini–Hochberg (BH) Corrected p -Values for the Final Models Examining Associations With Negative Emotions. Significant p -Values Are Reported in Bold

	Anxiety			Anger			Shame			
	β	SE	χ^2 (df)	p_{raw}/p_{BH}	β	SE	χ^2 (df)	p_{raw}/p_{BH}	β	SE
Step 1										
Sex ^a	.12	.05	5.45(1)	.020/.065	-.05	.06	0.87(1)	.351/.484	.13	.05
Age	.24	.06	18.03(1)	< .001/< .001	.09	.07	1.79(1)	.181/.258	-.05	.07
Step 2										
Sex ^a	.10	.05	3.49(1)	.062/.200	-.08	.05	2.38(1)	.123/.205	.09	.05
Age	.20	.05	14.07(1)	< .001/.002	.05	.07	0.58(1)	.448/.550	-.11	.07
Extraversion	-.03	.07	0.21(1)	.644/.849	-.07	.07	1.13(1)	.288/.576	.03	.07
Agreeableness	.01	.06	0.05(1)	.826/.887	-.01	.06	0.02(1)	.887/.887	.09	.06
Conscientiousness	.03	.06	0.18(1)	.668/.742	.03	.06	0.29(1)	.592/.741	.01	.06
Neuroticism	.28	.05	26.52(1)	< .001/< .001	.31	.05	32.40(1)	< .001/< .001	.28	.05
Openness	-.01	.07	0.02(1)	.889/.889	.01	.07	0.03(1)	.871/.889	-.12	.07
Step 3										
Sex ^a	.11	.05	4.21(1)	.040/.174	-.09	.06	2.63(1)	.105/.174	.09	.06
Age	.21	.06	14.50(1)	< .001/.001	.07	.07	0.91(1)	.341/.490	-.10	.07
Extraversion	.01	.07	0.01(1)	.926/.926	-.05	.07	0.58(1)	.446/.700	.05	.07
Agreeableness	-.01	.06	0.02(1)	.903/.968	-.01	.06	0.04(1)	.845/.968	.08	.06
Conscientiousness	.05	.06	0.51(1)	.476/.711	.04	.07	0.37(1)	.544/.711	.02	.07
Neuroticism	.22	.06	14.95(1)	< .001/< .001	.27	.06	20.27(1)	< .001/< .001	.25	.06
Openness	-.03	.07	0.25(1)	.620/.812	.01	.07	0.01(1)	.932/.932	.10	.06
Actively Approaching	.01	.06	0.01(1)	.989/.989	.10	.06	2.52(1)	.112/.298	-.11	.07
Withdrawal	.05	.06	0.63(1)	.429/.679	-.02	.06	0.07(1)	.797/.984	.01	.06
Positive Refocusing	-.09	.06	2.71(1)	.100/.166	.01	.06	0.01(1)	.997/.997	-.05	.06
Catastrophizing	.16	.05	8.99(1)	.003/.014	.05	.06	0.69(1)	.408/.815	-.01	.06

Table 4 (continued)

	Shame			Hopelessness			Boredom		
	χ^2 (df)	$p_{\text{raw}}/p_{\text{BH}}$	β	SE	χ^2 (df)	$p_{\text{raw}}/p_{\text{BH}}$	β	SE	χ^2 (df)
Step 1									
Sex ^a	5.66(1)	.017 /.065	.10	.05	3.26(1)	.071/.142	-.15	.05	7.88(1)
Age	0.47(1)	.494/.549	.07	.07	0.95(1)	.329/.411	.20	.07	7.80(1)
Step 2									
Sex ^a	2.89(1)	.089/.200	.07	.05	1.67(1)	.196/.280	-.17	.05	11.63(1)
Age	2.42(1)	.120/.240	.05	.07	0.47(1)	.495/.550	.15	.07	4.87(1)
Extraversion	0.17(1)	.679/.849	-.16	.07	5.43(1)	.020 /.053	-.15	.06	5.32(1)
Agreeableness	2.35(1)	.125/.596	.03	.06	0.31(1)	.579/.724	-.08	.06	1.81(1)
Conscientiousness	0.03(1)	.853/.853	.08	.07	1.43(1)	.231/.403	-.08	.06	1.65(1)
Neuroticism	26.77(1)	< .001 / < .001	.22	.06	16.31(1)	< .001 / < .001	.24	.05	20.89(1)
Openness	2.98(1)	.085/.422	.08	.07	1.18(1)	.277/.694	.04	.07	0.35(1)
Step 3									
Sex ^a	2.91(1)	.088/.174	.07	.05	1.71(1)	.191/.273	-.20	.05	14.63(1)
Age	2.14(1)	.143/.358	.07	.07	0.90(1)	.343/.490	.14	.07	4.17(1)
Extraversion	0.48(1)	.487/.700	-.10	.07	2.49(1)	.115/.287	-.13	.07	4.09(1)
Agreeableness	1.77(1)	.184/.855	.01	.06	0.01(1)	.968/.968	-.06	.06	0.89(1)
Conscientiousness	0.07(1)	.786/.786	.10	.06	2.21(1)	.137/.457	-.05	.06	0.55(1)
Neuroticism	17.97(1)	< .001 / < .001	.11	.06	3.64(1)	.057/.094	.23	.06	17.08(1)
Openness	2.43(1)	.119/.298	.05	.07	0.65(1)	.422/.812	.03	.07	0.21(1)
Actively Approaching	2.67(1)	.102/.464	.02	.06	0.08(1)	.777/.984	-.13	.06	4.89(1)
Withdrawal	0.03(1)	.855/.984	.23	.06	15.19(1)	< .001 /.001	.01	.06	0.02(1)
Positive Refocusing	0.70(1)	.403/.503	-.08	.06	1.85(1)	.174/.249	.02	.06	0.15(1)
Catastrophizing	0.04(1)	.840/.934	.16	.05	9.23(1)	.002 /.014	.02	.05	0.11(1)

^aSex was coded using 0 for males and 1 for females

Personality traits We found medium positive relations between: Extraversion and enjoyment ($\beta = .15$, $p = .016$) and hope ($\beta = .16$, $p = .019$); Conscientiousness and pride ($\beta = .23$, $p < .001$) and relief ($\beta = .15$, $p = .026$); Neuroticism and relief ($\beta = .13$, $p = .038$); and Openness and pride ($\beta = .14$, $p = .035$).

Emotion regulation strategies Withdrawal showed a medium negative link with enjoyment ($\beta = -.14$, $p = .014$), whereas Positive Refocusing medium positive links with enjoyment ($\beta = .17$, $p = .002$), pride ($\beta = .17$, $p = .003$), hope ($\beta = .19$, $p = .002$), and relaxation ($\beta = .17$, $p = .003$).

Summary of main findings Overall, the results suggest that positive emotions were primarily associated with personality traits and, to a lesser extent, with ER strategies, whereas demographic variables showed more limited associations. While Hypothesis 1 did not receive support, given the non-significant results regarding sex, we found a decrease in enjoyment with increasing age, in line with Hypothesis 2a. Extraversion, Conscientiousness, and Openness were positively related to selected positive emotions, providing partial support for Hypothesis 3a, while Neuroticism showed an unexpected positive association with relief. Among ER strategies, Positive Refocusing was consistently linked to higher levels of several positive emotions, whereas Withdrawal was negatively associated with enjoyment, providing partial support for Hypothesis 4a. Some of these patterns, however, should be interpreted with caution, as a small number of associations with personality traits and ER strategies did not remain statistically significant after applying the BH correction for multiple testing (i.e., the relations of Extraversion with enjoyment and hope, of Conscientiousness and Neuroticism with relief, of Openness with pride, and of Withdrawal with enjoyment; Table 3).

Negative emotions

Demographic variables (step 1) showed a limited contribution to negative emotions, as indicated by low marginal R^2 values across outcomes (Table 2). The inclusion of personality traits (step 2) markedly enhanced model fit for all negative emotions, as reflected in consistent reductions in AIC, significant model comparisons (all $ps < .001$), and notable increases in marginal R^2 . The addition of ER strategies (step 3) yielded further improvements in model fit for anxiety and hopelessness, as indicated by additional decreases in AIC and significant model comparisons ($ps < .01$), whereas no significant changes were observed for anger, shame, and boredom. Overall, the increase in marginal R^2 across steps suggests that personality traits accounted for a substantial portion of variance in negative emotions, with a more limited contribution of ER strategies. Conditional R^2 values were generally higher than marginal R^2 values, suggesting some additional contribution of random effects, although this difference was negligible in steps 2 and 3 for anxiety (Table 2).

The following results pertain to step 3 of the analyses (Table 4), which served as the final model for all outcomes to maintain consistency, even in cases where incorporating ER strategies did not significantly enhance the model fit (i.e., for anger, shame, and boredom). In the text, we present associations that reached significance before correcting p -values, and in the final summary we identify those that did not remain significant after the BH correction and should thus be interpreted with caution.

Demographic variables Sex showed a medium positive relation with anxiety ($\beta = .11$, $p = .040$) and a medium negative relation with boredom ($\beta = -.20$, $p < .001$) – indicating higher anxiety and lower boredom for females – but not with the other emotions. Age exhibited medium positive relations with anxiety ($\beta = .21$, $p < .001$) and boredom ($\beta = .14$, $p = .041$).

Personality traits Extraversion showed a medium negative link with boredom ($\beta = -.13$, $p = .043$), and Neuroticism medium/high positive links with anxiety ($\beta = .22$, $p < .001$), anger ($\beta = .27$, $p < .001$), shame ($\beta = .25$, $p < .001$), and boredom ($\beta = .23$, $p < .001$).

Emotion regulation strategies We found medium positive associations between Withdrawal and hopelessness ($\beta = .23$, $p < .001$), and between Catastrophizing and anxiety ($\beta = .16$, $p = .003$) and hopelessness ($\beta = .16$, $p = .002$). In addition, although the inclusion of ER strategies did not lead to a significant improvement in model fit for boredom, Actively Approaching was nevertheless negatively and moderately associated with this emotion ($\beta = -.13$, $p = .027$).

Summary of main findings Overall, the results suggest that negative emotions were associated with all three groups of factors, with personality traits showing the most consistent patterns across emotions. As for sex, females reported higher anxiety and lower boredom – no specific hypothesis was formulated for negative emotions. In line with Hypothesis 2b, anxiety and boredom displayed an increase with age. Neuroticism showed consistent positive associations with most negative emotions, and Extraversion was negatively related to boredom, providing partial support for Hypothesis 3b. Among ER strategies, Withdrawal and Catastrophizing were positively associated with selected negative emotions, whereas Actively Approaching was negatively related to boredom, providing partial support for Hypothesis 4b. Caution is warranted, as some associations did not remain statistically significant after BH correction for multiple testing (i.e., the relations of sex with anxiety, and of age, Extraversion, and Actively Approaching with boredom; Table 4).

Discussion

This study aimed to investigate the additive contribution of demographic, personality, and ER factors with respect to school-related achievement emotions, in a sample of fourth, sixth, and seventh-graders, attending primary and middle schools in Italy. Using the CVT (Pekrun, 2006, 2024) as the main theoretical framework, we examined how sex, age, Big Five traits, and two behavioral (Actively Approaching and Withdrawal) and two cognitive (Positive Refocusing and Catastrophizing) ER strategies were associated with five positive (enjoyment, pride, hope, relief, and relaxation) and five negative (anxiety, anger, shame, hopelessness, and boredom) emotions that students could feel toward school in general. To achieve this goal, we estimated 10 LMMs, one for each emotion, with the three groups of variables entered hierarchically in three steps. The final step was used to describe the associations for all emotions; however, the addition of ER strategies resulted in a significant improvement in model fit compared to step 2 (including only demographic and personality variables) only for enjoyment, pride, hope, relaxation, anxiety, and hopelessness.

Our first aim was to study the contribution of sex and age to students' emotional experience at school. In the final step of our analyses, we found no significant relations between sex and positive emotions. Therefore, our findings did not support Hypothesis 1 and previous research documenting a higher level of pleasant school-related emotions in females compared to males (Gentry et al., 2002; Raccanello et al., 2025). As for negative emotions, we underlined a lack of previous research on sex differences in the general school domain. In our study, females showed higher anxiety and lower boredom than males. Notwithstanding the relatively modest magnitude of the former finding, it is in line with prior research about test anxiety (Aydin, 2019; Hoferichter & Raufelder, 2015; Putwain, 2007; Putwain & Daly, 2014). This could reflect a general tendency for females to be more prone to anxiety than males, due to both biological and environmental (e.g., socialization processes) factors (McLean & Anderson, 2009). The result about boredom is in line with some evidence about a higher propensity for males to experience this emotion due to a greater need for external stimulation (Vodanovich & Kass, 1990; Vodanovich et al., 2011). Overall, these findings are consistent with the CVT (Pekrun, 2006, 2024) assumption that, although the structure of achievement emotions is considered universal, differences in mean levels between males and females remain possible. As for age, we found a significant relation with enjoyment, anxiety, and boredom. In line with Hypotheses 2a and 2b, older students enjoyed school less, tended to feel more anxious, and experienced increased boredom, compared to younger ones, although the association with anxiety should be interpreted with caution because it did not remain significant after the BH correction. This is broadly consistent with previous literature indicating a decline in positive achievement emotions and an increase in negative ones at progressing ages or grades, when considering both specific subjects (Lichtenfeld et al., 2023; Raccanello et al., 2013, 2019; Sakaki et al., 2024) and school in general (Gentry et al., 2002; Meyer & Schlesier, 2022; Vierhaus et al., 2016). In addition, such findings give further support to the literature highlighting a maladaptive developmental trend in students' affective and motivational experience (Bouffard et al., 2001; Hascher et al., 2022; Lepper et al., 2005). Even though the CVT (Pekrun, 2006, 2024) does not specify developmental trajectories of achievement emotions, examining these patterns across age groups may help understand how emotional experiences evolve over time. In this sense, the inclusion of primary and middle school students, who have been relatively underrepresented in prior research, provides further insight into the developmental aspects of students' emotions at school (Pekrun, 2024).

The second aim was to investigate the relations between the Big Five personality traits and school-related emotions. Based on the results from the final step of the analyses, we found that positive emotions had positive relations with certain personality traits: enjoyment and hope with Extraversion, pride with Conscientiousness and Openness, and relief with Conscientiousness. These findings provide partial support for Hypothesis 3a and are broadly consistent with previous findings (Raccanello et al., 2025), although the associations of Extraversion with enjoyment and hope, of Openness with pride, and of Conscientiousness with relief should be interpreted with caution because they did not remain statistically significant after the BH correction. Unexpectedly, we found a positive – albeit relatively modest – association between relief and Neuroticism, which also did not remain significant after the BH correction but is in line with previous studies involving university students (de la Fuente et al., 2020; Pekrun et al., 2023). As argued by Pekrun et al. (2023), it is plausible that more neurotic people, who usually report heightened levels of negative feelings, are more inclined to feel a sense of relief, as it is the positive emotion that follows the experience of a stressful situation. On the other side, we found that all

negative emotions (except hopelessness) were positively associated with Neuroticism, and that boredom was also negatively related to Extraversion – despite its relatively modest magnitude and although this association did not remain statistically significant after the BH correction –, partially in line with Hypothesis 3b and previous studies (Hoferichter & Raufelder, 2015; Hoferichter et al., 2014; Raccanello et al., 2025; Sorić et al., 2013). On the whole, these results help shed light on how primary and middle school students' personality traits can influence their emotions at school. Not surprisingly, the most influential were Extraversion and Neuroticism: indeed, among the Big Five, they are considered those with the strongest affective component (Verduyn & Brans, 2012). However, Conscientiousness and Openness also had a significant role in influencing positive emotions at school, confirming their relevance in achievement settings, which are usually among the best predictors of academic performance (Dumfart & Neubauer, 2016; Gatzka, 2021). From a CVT perspective (Pekrun, 2006, 2024), these findings support the role of personality as a distal antecedent of achievement emotions, showing consistent patterns of direct associations between Big Five traits and discrete positive and negative emotions, even in primary and middle school students.

As the last aim, we examined how students' general tendency to use some ER strategies in their lives is associated with their emotions at school. We focused on two behavioral and two cognitive strategies, mostly understudied in educational research, that can be utilized in the four stages preceding the generation of an emotion according to the ERAS model (Harley et al., 2019). After controlling for demographic and personality characteristics, our results provided partial support for Hypotheses 4a and 4b. Students who used Withdrawal to cope with negative events reported less enjoyment and more hopelessness at school, although the association with enjoyment did not remain statistically significant after the BH correction; those who utilized Positive Refocusing felt more proud, hopeful, and relaxed; and those who employed Catastrophizing reported more anxiety and hopelessness. Moreover, Actively Approaching showed a negative relation to boredom, although this association did not remain statistically significant after the BH correction and, for this emotion, the addition of ER strategies among the predictors did not result in a statistically significant additional proportion of variance explained. These results are broadly consistent with the view of Actively Approaching and Positive Refocusing as adaptive, and of Withdrawal and Catastrophizing as maladaptive, considering in our case not the emergence of psychopathological symptoms (as Garnefski et al., 2001, 2007, 2017; Kraaij & Garnefski, 2019; Şevki Keskiner et al., 2025), but students' emotional experience in academic contexts (Mudło-Głagolska & Larionow, 2023). Through the lens of the CVT (Pekrun, 2006, 2024), our results support the relevance of ER processes as distal antecedents of students' emotions toward school. The findings also suggest that strategies positioned at different stages of the emotion-generative process may relate to specific emotions. However, this interpretation should be treated cautiously, as ER strategies were assessed as general tendencies rather than as school-specific regulatory responses.

Taken together, the findings suggest that demographic characteristics, personality traits, and ER strategies contribute differently to students' emotional well-being at school. While demographic variables were associated with a limited set of emotions, personality traits showed broader patterns of associations, with Neuroticism consistently linked to more negative emotional experiences, and Extraversion, Conscientiousness, and Openness to more positive emotional experiences. ER strategies, in turn, were differentially associated with specific emotions, with more adaptive strategies (Actively Approaching and Positive Refocusing) linked to more positive emotional patterns and less adaptive ones (Withdrawal and Catastrophizing) to more negative outcomes. Within the CVT framework (Pekrun, 2006,

2024), these results can be interpreted as reflecting the additive contribution of distal antecedents operating at different levels, which may shape achievement emotions in different ways. These findings should, however, be interpreted with some caution, as a small number of associations did not remain statistically significant after correction for multiple testing. This suggests that some of these relations may be less robust and could attenuate or disappear when considered within a more stringent or integrated analytical framework.

From a theoretical perspective, this study advances knowledge on the concurrent contribution of some underexamined factors in affecting achievement emotions, especially when referring to the general school domain and to primary and middle school students. It corroborated the assumptions of the CVT (Pekrun, 2006, 2024) by showing how some stable characteristics – such as demographic variables and personality traits – along with more malleable factors – like ER strategies – relate to 10 emotions, varying in their valence and arousal.

Despite the correlational nature of the results, the findings may also offer some insights with potential applied implications. More broadly, they contribute to identifying key correlates of emotional well-being among primary and middle school students. Based on our results, teachers and other practitioners working in school contexts (e.g., school psychologists) may consider how more stable demographic and personality characteristics are associated with students' emotions. Specifically, they may pay particular attention, on the one hand, to older students, and on the other hand, to less extraverted, conscientious, open-minded, and more neurotic ones, as they tended to report more negative than positive emotions compared to their counterparts. As regards sex, practitioners may take into account the higher propensity for females to report anxiety and for males to report boredom. Moreover, our findings showed that students reporting a greater tendency to use Actively Approaching and Positive Refocusing in their everyday lives also revealed more adaptive emotional patterns at school compared to those reporting higher use of strategies such as Withdrawal and Catastrophizing. These findings suggest that, for example, classroom-based activities aimed at encouraging active problem-solving and more adaptive thinking patterns (e.g., prompting students to take actions to address problems or to focus on positive thoughts) may be particularly relevant for supporting students' emotional experiences. Given the malleable nature of ER strategies (Wright et al., 2025), these results may also inform future intervention research aimed at promoting more adaptive strategies and reducing reliance on less adaptive ones. In addition, knowledge of students' personality profiles may help identify those who could benefit more from such interventions. Based on the CVT (Pekrun, 2006, 2024), supporting students' emotional experiences at school may be associated with improvements in both their well-being and learning.

Limitations and future directions

This study suffers from a number of limitations that can be addressed in future research. First, despite a cross-sectional design, we hypothesized a particular direction in the relations based on theory (i.e., CVT; Pekrun, 2006, 2024) and the level of generality of the assessed constructs – personality and ER strategies (assessed at a general level), in turn affecting achievement emotions (related to a particular context, i.e., school). However, the present data do not allow firm conclusions about directionality. In particular, ER strategies may not only influence achievement emotions but also be shaped by them. Therefore, the observed associations should be interpreted as correlational, and future research using longitudinal designs is needed to clarify potential reciprocal relations among variables. Second, another limitation concerns the additive nature of the analytical approach. Although LMMs with

a hierarchical entry of the variables allowed us to examine the relative contribution of different predictors, they are not well-suited to capturing more complex relations among variables, such as interactional or mediational processes. As a result, the present study does not fully address the potential interplay among demographic, personality, and ER factors. Future research should adopt more integrative analytical approaches (e.g., interaction models, path analyses, or structural equation modeling) to better examine such dynamics. Third, we used single-item measures to assess the 10 school-related achievement emotions included as outcome variables. This choice limits the psychometric robustness of the analyses, as aspects such as internal consistency and structural validity could not be examined. However, consistent with previous research (e.g., Goetz et al., 2010; Nett et al., 2011), this approach was adopted to reduce cognitive load, particularly given the young age of the participants. Moreover, we did not aggregate the five positive and five negative emotions into broader composite factors, as we aimed to preserve the content specificity of distinct emotions, even when sharing the same valence. Future research should aim to integrate content specificity and psychometric robustness by examining discrete emotions while assessing them with multi-item measures. Fourth, we assessed achievement emotions generally associated with school, without distinguishing among different domains (e.g., mathematics or native language), in line with previous studies (Meyer & Schlesier, 2022; Moè et al., 2009; Obermeier et al., 2022; Raccanello et al., 2025; Vierhaus et al., 2016). We chose to do this to maintain a similar level of generality in comparison to the other measures, i.e., personality and ER strategies. However, considering the importance of domain specificity of achievement emotions within the framework of CVT (Goetz et al., 2006; Raccanello et al., 2013), future research should investigate how individual differences and strategies for managing emotions impact students' emotional experiences in various evaluative and non-evaluative situations across different school subjects. Fifth, ER was measured by asking students how much they used a certain strategy for coping with stressful situations in their everyday life. However, recent research demonstrated that, in achievement contexts, ER strategies are domain-specific as well, despite showing moderate to large correlations with their general counterparts (Stockinger et al., 2025). This difference in contextual specificity between general ER strategies and school-related achievement emotions may have attenuated the observed associations and limits the interpretability of the findings. At the same time, the use of general ER measures can be justified by their conceptualization as relatively broad tendencies that extend across contexts. However, this approach may not fully align with the domain-specific nature of achievement emotions, as emphasized in the CVT framework (Pekrun, 2006, 2024). Future studies could replicate our work by leading students to think about school-related situations before responding (e.g., Schlesier et al., 2026) or by using instruments developed specifically for achievement settings (e.g., *Academic ER Questionnaire*, AERQ; Burić et al., 2016). Sixth, we did not assess school-related control and value appraisals. According to CVT (Pekrun, 2006, 2024), these appraisals represent proximal antecedents of achievement emotions. Therefore, their omission limits the explanatory scope of the present theoretical interpretation. Future studies should include control and value appraisals in order to examine their role in linking more distal antecedents to emotional outcomes, including their potential mediating function. Seventh, we did not include fifth-graders in our sample due to practical constraints. However, the age range characterizing our sample also broadly included ages typical of students attending that class level. Eighth, our sample was limited to students from a Western, educated, industrialized, rich, and democratic (WEIRD) country. This impedes the generalization of our results to other contexts. Even though the CVT (Pekrun, 2006, 2024) sustains the universality of the relations between the

constructs independently of the culture or the country, there is a need for further research to confirm the validity of this assumption (Pekrun, 2024).

Conclusions

This study examined the additive contributions of demographic characteristics, personality, and ER strategies in relation to 10 achievement emotions that primary and middle school students could experience at school. Our findings are in line with the assumptions of the CVT (Pekrun, 2006, 2024), highlighting the role of sex, age, Big Five traits, and two behavioral and two cognitive ER strategies as relevant correlates of emotional well-being in educational contexts. Overall, these results may help teachers and other practitioners better understand students' emotional experiences at school in light of relatively stable individual characteristics, while also informing future longitudinal and intervention studies on more malleable ER abilities.

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Author contribution Conceptualization: GV, DWP, RB, DR; Data curation: GV; Formal analysis: GV, DWP; Investigation: GV, RB, DR; Methodology: GV, DWP, DR; Project administration: GV, RB, DR; Resources: GV, RB, DR; Software: GV, DWP; Supervision: DWP, RB, DR; Validation: GV, DWP, RB, DR; Visualization: GV; Writing—Original Draft: GV; Writing—Review & Editing: DWP, RB, DR.

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Availability of data and material Materials and analysis code for this study are available on the Open Science Framework (OSF) at the following link: https://osf.io/hjpn3/overview?view_only=1069ee7e39e44ae09401a91c1676b9b9. This study's design and its analysis were not pre-registered.

Declarations

Ethics approval and consent to participate The study was approved by the Ethical Committee of the Department of Human Sciences, University of Verona (protocol numbers 161865 of 17/04/2023, and 15396 of 08/01/2025). After obtaining the approval of the heads of the schools, parents or legal guardians were asked to sign the written informed consent form for students' participation.

Consent for publication We declare that the work described has not been published previously, that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder. A previous version of this work is part of Giada Vicentini's PhD dissertation (<https://hdl.handle.net/11562/1182408>). This article is based on data partially used in a previous paper (Vicentini et al., 2026). Giada Vicentini will be serving as the corresponding author for this manuscript. The co-authors listed in the byline have agreed to the byline order and to submission of the manuscript in this form. The corresponding author has assumed responsibility for keeping the co-authors informed of the progress through the editorial review process, the content of the review, and any revisions made.

Competing interests The authors declare they have no financial interests. Daniela Raccanello is an Editorial Board Member of the European Journal of Psychology of Education. The other authors have no relevant non-financial interests to disclose.

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Current Themes of Research

Her research interests mainly regard the psychology of emotions and the psychology of emergency. Her research topics include emotions and emotion regulation strategies characterizing students of different ages in learning contexts; emotional competence; personality; and training programs about emotions and resilience.

Most Relevant Publications in the Field of Psychology of Education

- Raccanello, D., Vicentini, G., Trifiletti, E., & Burro, R. (2025). Personality, achievement emotions, and school well-being in primary and lower-secondary school students. *Zeitschrift für Erziehungswissenschaft*, 28(2), 467–497. <https://doi.org/10.1007/s11618-024-01289-6>
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Current Themes of Research

How motivation, emotion, and the classroom environment, impact and in turn are impacted by, learning and achievement.

Most Relevant Publications in the Field of Psychology of Education

- Held, J., Meje, M., Putwain, D. W., & Hascher, T. (2025). Relationships between inter- and intra-individual emotions and learning outcomes of vocational students. *Learning and Individual Differences*, 120, Article 102682. <https://doi.org/10.1016/j.lindif.2025.102682>
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- Putwain, D. W., Daumiller, M., von der Embse, N., & Nicholson, L. J. (2024). Emotional intersection: Delineating test anxiety, emotional disorders, and student well-being. *Journal of School Psychology*, 107, Article 101390. <https://doi.org/10.1016/j.jsp.2024.101390>

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Current Themes of Research

His main research areas, according to a phenomenological-experimental perspective, are: psychophysics, spatial perception, visuo-spatial problem solving, sensory and emotional analysis, development of instruments for measuring psychological variables, personality psychology and individual differences.

Most Relevant Publications in the Field of Psychology of Education

- Raccanello, D., Vicentini, G., Moè, A., Lichtenfeld, S., & Burro, R. (2025). Malleability of emotions: Developing the Robust Incremental Beliefs about Emotion Scale for elementary school Children (RIBES-C). *Applied Developmental Science*. Advance online publication. <https://doi.org/10.1080/10888691.2025.2498730>
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- Burro, R., Vicentini, G., & Raccanello, D. (2023). Big Five personality traits and coping strategies of Italian university students during the COVID-19 pandemic first wave. *Frontiers in Psychology*, 14, Article 1150674. <https://doi.org/10.3389/fpsyg.2023.1150674>
- Raccanello, D., Vicentini, G., Trifiletti, E., & Burro, R. (2021). A Rasch analysis of the School-Related Well-being (SRW) scale: Measuring well-being in the transition from primary to secondary school. *International Journal of Environmental Research and Public Health*, 18(1), Article 23. <https://doi.org/10.3390/ijerph18010023>

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Current Themes of Research

Her research interests mainly refer to the psychology of emotions and the psychology of emergency. Her research areas include emotions and motivation at school, development of emotional competence, and emotions related to disasters.

Most Relevant Publications in the Field of Psychology of Education

- Raccanello, D., Vicentini, G., Moè, A., Lichtenfeld, S., & Burro, R. (2025). Malleability of emotions: Developing the Robust Incremental Beliefs about Emotion Scale for elementary school Children (RIBES-C). *Applied Developmental Science*. Advance online publication. <https://doi.org/10.1080/10888691.2025.2498730>
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Motivation for submitting this article to the journal We decided to submit our paper to the European Journal of Psychology of Education (EJPE) because we acknowledge how it is among the best journals for disseminating research about psychological aspects related to learning. Our study explores the role of both stable (sex and personality) and malleable (emotion regulation strategies) personal antecedents of a variety of emotions experienced by students in primary and middle school. Given the significance of our findings at both theoretical and practical levels, we believe our paper aligns well with the EJPE's mission, providing valuable insights to enhance students' well-being in learning environments.