

Strategies for regulating achievement emotions: Conceptualization and relations with university students' emotions, well-being, and health

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ABSTRACT

Background: Students' achievement emotions profoundly influence their learning, academic performance, well-being, and educational trajectories. Understanding how students regulate these emotions is crucial for their academic flourishing.

Aims: We examined students' strategies for regulating three common achievement emotions (enjoyment, anxiety, boredom), and how these strategies relate to emotions, academic well-being, health problems, and achievement-related outcomes.

Theoretical framework: Our theoretical model of emotion regulation strategies is derived from the control-value theory of achievement emotions (Pekrun, 2006) and Harley et al.'s (2019) model of emotion regulation in achievement settings. It considers six groups of strategies: situation selection, social support, reappraisal, expression, suppression, and competence development.

Samples: Participants included 350 (Study 1; Germany), 359 (Study 2; England), and 200 (Study 3; Germany) university students.

Methods: Studies 1 and 2 were cross-sectional. Study 3 employed a five-wave prospective design and focused on course-specific achievement emotion regulation over one semester. We used a newly developed context- and emotion-specific measure of the six strategies targeting enjoyment, anxiety, and boredom (Regulation of Achievement Emotions Questionnaire, RAEQ).

Results: Strategies were linked to students' emotions, well-being, health, and academic achievement (perceived success, Studies 1 and 2; end-of-semester test scores, Study 3) across all three studies. Furthermore, achievement emotion regulation strategies were related to, but distinct from, general emotion regulation strategies.

Conclusions: Findings highlight the importance of students' regulation of both positive and negative emotions, suggest that emotion regulation is context-specific, and imply that reappraisal and competence development are especially adaptive. We discuss implications for educational practice and future research.

1. Introduction

Mounting evidence demonstrates that students' achievement-related emotions impact a host of critical outcomes, including their learning, well-being and health, and educational and occupational trajectories (Barroso et al., 2021; Camacho-Morles et al., 2021; Krannich et al., 2022; Loderer, Pekrun, & Lester, 2020; Pekrun et al., 2023; Respondek, Seufert, Stupnisky, & Nett, 2017; Richardson, Abraham, & Bond, 2012).

Supporting students' emotional self-regulation has thus been flagged as an important means for promoting student well-being and academic flourishing at all levels of education including university (Ben-Eliyahu, 2019; Frenzel, Goetz, & Stockinger, 2024; Goetz & Bieg, 2016), especially as mental health in university student populations seems to be declining across the globe (Heumann, Palacio Siebe, Stock, & Heinrichs, 2024; Lipson et al., 2022; McCloud, Kamenov, Callender, Lewis, & Lewis, 2023). In part, these developments can be traced back to

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increasing academic demands that build throughout the school years and culminate in increasing worries about achievement and performance pressure at tertiary levels of education that students must balance with increasing financial and familial responsibilities (McCloud et al., 2023), implying close linkages with achievement emotions connected to academic successes and failures.

At the same time, higher education students are expected to develop extensive self-regulatory skills for actively managing their learning, motivation, and emotions (Dresel et al., 2015). Moreover, given the importance of achievement emotions for well-being, equipping students with effective strategies for regulating emotions may be one important means for mitigating the widely lamented mental health crisis in university students. However, insight into students' strategies for regulating achievement emotions is still scarce (Harley, Pekrun, Taxer, & Gross, 2019). Research comparing students' strategies for regulating emotions in academic versus non-academic settings (Rottweiler, Taxer, & Nett, 2018) supports the assumption that emotion regulation (ER) is context-specific (Aldao, 2013) and underscores the importance of contextualized inquiry into ER in academic settings.

In the present research, we built on this assumption. Using Pekrun's, (2006, 2021) control-value theory (CVT) as a theoretical framework, we examined university students' strategies for regulating three frequently experienced and functionally important achievement emotions (enjoyment, anxiety, boredom), and how these strategies relate to these emotions as well as well-being and health. Furthermore, we explore relations with more distal achievement outcomes. We report on three studies with samples from two countries (Germany; UK) that examine the structures and correlates of students' ER strategies using context- and emotion-specific measures of achievement emotion regulation.

1.1. Achievement emotions

Achievement emotions are tied to activities (e.g., studying) or outcomes (i.e., success or failure) that are judged according to competence-based standards of quality (Pekrun, 2006). Like emotions more generally, they involve multicomponent changes in different organismic subsystems which refer to affective (i.e., subjective feeling), cognitive, physiological, motivational, and expressive-behavioral components of emotions. Following Gross (2015), emotions and moods can be viewed as related psychological states that involve affective valuation, but can be distinguished in terms of their duration (moods tend to last longer than emotions) and target object or referent (moods tend to lack a clear object focus).

In academic settings, students can experience a variety of achievement emotions that can be classified along three major dimensions: valence (positive/pleasant vs. negative/unpleasant), physiological arousal (high arousal/activating vs. low arousal/deactivating), and object focus or referent of emotions (prospective achievement outcomes; retrospective achievement outcomes; concurrent achievement activities). In this research, we focus on three emotions that are both highly prevalent as well as functionally important in students' academic lives (Camacho-Morles et al., 2021; Earl, Bishop, Miller, Davison, & Pickerell, 2024; Loderer et al., 2020; Pekrun et al., 2023; Peterson, Brown, & Jun, 2015; Tze, Daniels, & Klassen, 2016): positive activating enjoyment and negative deactivating boredom, both of which can be conceptualized as activity-related emotions experienced when completing assignments, studying, or attending class, and negative activating anxiety targeting prospective achievement outcomes (i.e., performance on future tests and assignments). Because these achievement emotions are common and impactful, they can be viewed as focal targets of students' self-regulatory efforts and were thus included in the Regulation of Achievement Emotions Questionnaire (RAEQ) used in the present research (see section 3.2.3.1). Moreover, as these three emotions differ in terms of valence, arousal, and object focus, they provide an ideal starting point for exploring the relevance of emotion-specific assessment of regulatory strategies.

1.2. Regulation of achievement emotions

The present research focuses on students' emotional *self*-regulation, that is, the regulation of one's own rather than others' emotions, which can be defined as including any "attempts to influence which emotion one has, when one has them, and how one experiences or expresses these emotions" (Gross, 2015, pp. 4–5). This definition has also been adopted by scholars studying ER in academic settings (Ben-Eliyahu & Linnenbrink-Garcia, 2013; Burić, Sorić, & Penezić, 2016; Frenzel et al., 2024; Harley, Pekrun, et al., 2019; Jarrell & Lajoie, 2017; Pekrun, 2021; Rottweiler et al., 2018; for earlier literature on coping with test anxiety and ER in educational settings, see Schutz & Davis, 2000). Following Gross (2015), individuals may strive to increase (i.e., upregulate) positive or to decrease (i.e., downregulate) negative emotions, both of which are examples of *prohedonic* regulation; alternatively, they may engage in *contrahedonic* regulation and seek to downregulate positive or upregulate negative emotions (Gross, 2015). While *contrahedonic* regulation is often tied to instrumental goals, as may be the case when suppressing positive emotions when outperforming peers to avoid negative social consequences (Schall, Martiny, Goetz, & Hall, 2016), *prohedonic* regulation involving motivation to increase pleasant and minimize unpleasant affective experience seems to be more common in daily life and nonclinical populations (Tamir, 2016).

1.2.1. Fundamental assumptions about regulatory strategy use

There are a number of ER strategies individuals can draw on. The selection, use, and impact of these strategies on different outcomes is shaped by individual and contextual-situational factors (see Gross & Ford, 2024, for current theorizing and evidence). Accordingly, strategy use and effectiveness can vary intraindividually depending on current situational demands or regulatory goals, as demonstrated in studies on momentary strategy use via experience sampling (ESM). In higher education, Rottweiler et al. (2018) found that students' use of regulatory strategies measured via ESM over one week prior to an exam differed for exam- vs. non-exam-related emotions; moreover, the impact of specific regulatory strategies on subsequent mood differed across exam- vs. non-exam-related situations.

In addition to being context- and emotion-specific, ER is also person-specific: Individuals can develop different patterns of habitual ER strategy use which may be linked to factors ranging from individual neurobiological and personality characteristics to socialization processes (McRae & Gross, 2020). This aligns with the assumption that individual differences can also drive experiences of emotions. For achievement emotions, these include dispositional differences in cognitive abilities or learning-related beliefs (e.g., goal orientations or attributional tendencies; Daniels et al., 2008; Perry & Hamm, 2017). Consequently, achievement emotions can vary within and between individuals across situations or contexts, but they are also driven by individuals' control-value appraisal tendencies and thus interindividually relatively stable—in other words, patterns of emotional experience can be person- and context-specific (Dirk & Nett, 2022; Pekrun et al., 2023). This arguably extends to regulatory efforts targeting these emotions as well. While research has increasingly focused on intraindividual variability in momentary ER, individual habits and momentary strategy use can converge substantially, and regulatory habits are meaningfully linked to individuals' health, well-being, and social functioning (Griffin & Howard, 2022; Willroth & John, 2024), underscoring the importance of examining students' *habitual* use of regulatory strategies.

1.2.2. Strategies for regulating achievement emotions

A central corollary of CVT holds that achievement emotions, their distal and proximal antecedents, and their outcomes are linked by reciprocal causation over time (Fig. 1; for evidence, see Chen & Leung, 2024; Putwain, Wood, & Pekrun, 2022). For instance, performance outcomes are important sources of students' competence beliefs and control appraisals, thus shaping future emotions. Accordingly,

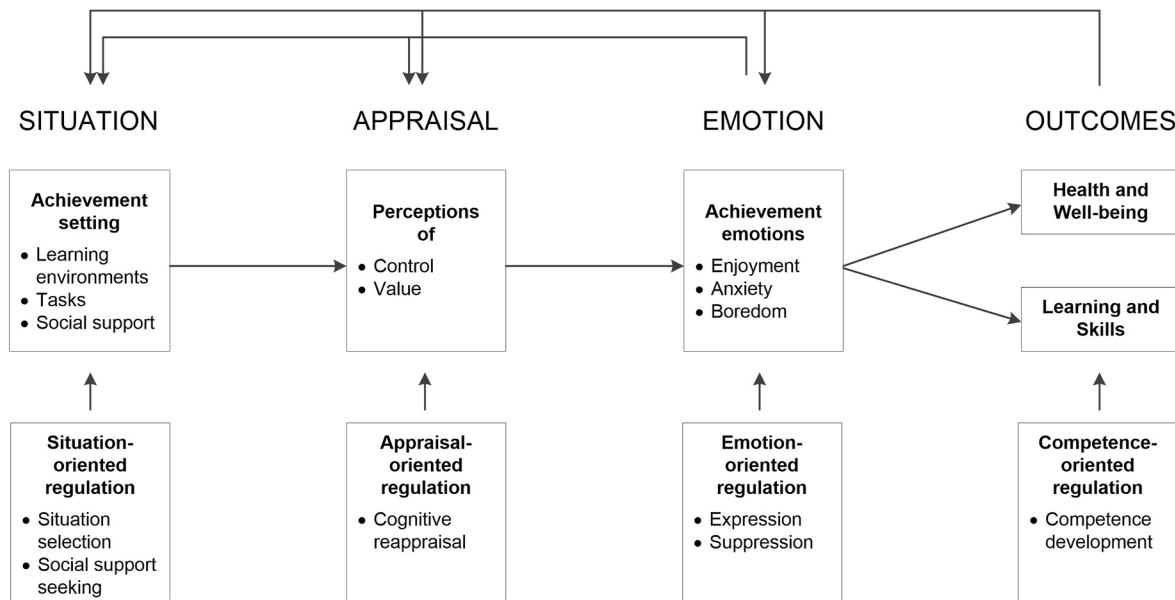


Fig. 1. Theoretical framework: Strategies for regulating achievement emotions, antecedents, and outcomes.

achievement emotions can be regulated by targeting different elements of these reciprocal feedback loops: (1) the emotions themselves (i.e., *emotion-oriented regulation*), (2) their appraisal antecedents (i.e., *appraisal-oriented regulation*), (3) achievement situations (i.e., *situation-oriented regulation*), and (4) learning-related skills and knowledge (i.e., *competence-oriented regulation*; Pekrun, 2021; Pekrun & Stephens, 2009; see Fig. 1). This view closely aligns with Gross's (2015) process model of ER (see also Burić et al., 2016; Harley, Pekrun, et al., 2019).

Emotion-oriented regulation strategies are geared towards changing affective (experiential), behavioral, or physiological parameters of emotional responding (cf. category of response modulation strategies; Gross, 2015). This can include using relaxation techniques or alcohol/drugs to downregulate anxiety about an exam, but also expression or suppression of emotions. Among these strategies, suppression has received by far the most scholarly attention and can include efforts to conceal expressive behaviors (i.e., expressive suppression) or inhibit affective experience (i.e., experiential suppression). Prior studies indicate that suppression is frequently used in higher education (Burić et al., 2016; Rottweiler et al., 2018, 2023), but evidence is mostly limited to its use for downregulating negative emotions. Emotional expression, in contrast, has been studied less systematically, especially in academic settings. It involves overt displays of emotion that can fulfill social-communicative functions or allow for emotional relief via venting; it may also be used to intensify and prolong the experience of positive emotions (McRae & Gross, 2020).

Appraisal-oriented regulation strategies involve reframing one's perceptions and cognitive evaluations of the self, internal, or external-situational circumstances (i.e., *reappraisal*; Gross, 2015). CVT holds that appraisals pertaining to the controllability and value of achievement-related activities and outcomes constitute proximal predictors of achievement emotions (Pekrun, 2006, 2021; see Fig. 1). As cumulative evidence has shown (see Frenzel et al., 2024), enjoyment is typically positively related to individuals' perceived control and to the value they ascribe to learning materials or outcomes. In other words, enjoyment is highest when individuals feel competent and able to master a given task that is of personal relevance to them. When learning tasks and outcomes are valued, but individuals doubt their ability to meet academic demands and avoid failure, implying low perceived control, they likely experience anxiety. Boredom, in contrast, is experienced when learning activities and outcomes lack personal value and perceived control is either too high (underchallenge) or—as more

commonly found in post-secondary educational settings (Pekrun et al., 2023)—too low (overchallenge). Accordingly, regulating achievement emotions via reappraisal should be geared towards recalibrating perceptions of personal competence and the likelihood of success (or failure), and of the value of learning and achievement (Harley, Pekrun, et al., 2019). Boosting perceived control should help increase enjoyment and decrease anxiety or boredom resulting from overchallenge; additionally, striving for optimal levels of challenge should help reduce boredom triggered by excessively high levels of perceived control. Moreover, increasing valuation of learning materials should increase enjoyment and reduce boredom, and anxiety may be downregulated by decreasing excessive valuation of achievement outcomes, particularly of failure.

Situation-oriented regulation targets distal situational antecedents of emotions that shape students' control and value appraisals. This includes approaching or avoiding situations expected to give rise to certain emotions (i.e., situation selection), as well as modification strategies that aim to alter situational circumstances. As the latter often results in the creation of 'new' situations, the distinction between situation selection and modification can be blurry (Gross, 2015). Situational parameters that matter for students' emotions and their regulation include perceptions of learning environments, tasks, or social interaction and relationships (e.g., Bieg, Dresel, Goetz, & Nett, 2022; Lazarides & Buchholz, 2019; Mainhard, Oudman, Hornstra, Bosker, & Goetz, 2018). For example, in anticipation of the emotional impact of academic situations, students may select courses on topics they find particularly appealing, avoid those they perceive as too difficult, or skip class sessions on due dates. Such strategies may be particularly relevant in higher education, where students typically have more degrees of freedom in terms of such choices as compared with pre-tertiary levels of education. To regulate emotions, students may also put off studying or procrastinate on assignments to disengage from aversive activities. Furthermore, they can engage in social situations and interaction to procure connectedness, comfort, consolation, or solicit advice from others (Rimé, 2024). Social support seeking may involve a certain degree of reliance on external guidance from others; however, to the degree that students actively initiate social contact to receive emotional support from others, this strategy constitutes an important means for *self-regulating* emotions (Burić et al., 2016; Rime, 2024).

Finally, *competence-oriented regulation* of emotions as originally proposed by Pekrun (2006; Pekrun and Stephens, 2009) can be

conceptualized as targeting personal development and encompasses enhancing competencies in terms of subject matter knowledge, skills, or study strategies (see Webster and Hadwin, 2015, for a similar definition). More specifically, competence development strategies can involve, for example, actively investing effort to work towards mastery, understanding, and good grades; deploying effective learning strategies (e.g., organizational strategies involving study plans); identifying and closing knowledge gaps; and actively participating in class (see also Burić et al., 2016). As such, these strategies can impact individuals' chances for academic success as well as their perceptions of control over learning and achievement, which, in turn, shape their emotions.

Prior research on students' regulation of negative affect speaks to the assumption that the aforementioned strategies are distinguishable and represent different approaches to managing achievement emotions in university settings (Burić et al., 2016). However, it is plausible to assume that habitual reliance on certain strategies is related to the habitual use of other strategies (Willroth & John, 2024). In particular, frequent reliance on suppression may be negatively related to use of expression. In contrast, expression may be positively related to social support seeking, which is likely attributable to the social-communicative consequences expression may share with seeking support from others (see, e.g., Olderbak, Uusberg, MacCann, Pollak, & Gross, 2023; for similar findings and discussion).

1.2.3. Correlates of achievement emotion regulation

Research on determinants and consequences of the use of different strategies for regulating achievement emotions is still scarce, especially in terms of causal relations. Accordingly, in this section, we consider potential *correlates* of students' regulatory approaches toward managing achievement emotions. Given the increasing pressure, competition, and uncertainties students in higher education are facing globally (Lipson et al., 2022; McCloud et al., 2023), and the growing concern for their mental health, we put particular emphasis on linkages between students' self-regulation of achievement emotions with their emotional experiences and well-being (see Fig. 1). We preface the following review with two assumptions.

First, we contend that ER strategies are not adaptive or maladaptive per se; instead, their availability and impact likely depend on situational and individual factors (Bonanno & Burton, 2013; Pekrun & Stephens, 2009). However, habitual reliance on certain strategies may be systematically linked to different correlates (see 1.2.1). In addition, we assume that relations between habitual ER strategy use and emotions, well-being, and health are reciprocal in nature. In other words, they should influence each other over time. Generally, emotions, but also well-being and health, should influence whether and how students regulate their emotions; their use of regulatory strategies, in turn, should influence their subsequent emotions, well-being, and health. This may be particularly important to consider when interpreting findings from correlational (and, in particular, cross-sectional) research. Positive and negative correlations between emotions and habitual ER strategy use, for instance, may be driven by different causal effect scenarios implying different positive or negative feedback loops. Some of these possible feedback loops are the following.

First, a given emotion can positively impact (i.e., increase) the subsequent use of a given ER strategy, and the use of that strategy can positively impact subsequent levels of that emotion (i.e., positive feedback loop). This would result in a positive overall correlation between the emotion and ER strategy. A "classic" example for a maladaptive feedback loop following this pattern stems from clinical psychological research, which has shown that habitual experiences of anxiety and depressive moods boost reliance on rumination-focused strategies, which, in turn, increase anxiety and depression (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Positive feedback loops may also occur for positive emotions, however. For instance, high levels of enjoyment may propel individuals to express this emotion; expression of enjoyment may, in turn, help prolong or intensify the experience of this

emotion.

Second, a given emotion may positively impact the use of a given ER strategy, but the use of that strategy may negatively impact (i.e., reduce) the subsequent experience of that emotion, amounting to a negative feedback loop. Depending on the relative strength of these effects, overall correlations between the emotion and ER strategy will be positive if the positive impact of the emotion on subsequent ER strategy use is stronger than the reverse negative effect. Correlations will be negative if the negative effect of ER strategy on subsequent emotional experience is stronger, and they can amount to a zero correlation if both effects are equally strong. Accordingly, for negative emotions, zero or negative correlations can point to adaptive feedback loops, as they reflect that subsequent levels of unpleasant emotions are reduced. For example, anxiety may prompt the use of relaxation techniques or seeking social support, both of which can help to downregulate anxiety. Conversely, positive correlations can point to ineffective ER strategies that fail to downregulate negative emotions. For positive emotions, this kind of feedback loop would be maladaptive as the emotion prompts use of the strategy, but the strategy reduces rather than increases the positive emotion. Positive correlations would imply that any such dampening effect of the strategy on subsequent positive emotion may be relatively weak. Zero or negative correlations would imply that this maladaptive effect is stronger than the positive effect of emotion on strategy use.

Third, a given emotion may negatively impact (i.e., reduce) reliance on a given ER strategy, but the use of that strategy may boost subsequent levels of that emotion. In combination, these effects would also amount to a negative feedback loop. As in the previous scenario, the direction of overall correlations between the emotion and ER strategy depends on the relative strength of the effects. The correlations will be positive if the positive effect of the strategy on subsequent emotion is stronger than the negative effect of the emotion on strategy use, negative if the effect of the emotion on strategy use is stronger, or zero if both effects are equally strong. Again, these patterns of linkages may point to differentially adaptive (or desirable) functions of ER strategies for negative versus positive emotions. For negative emotions, positive correlations indicate that the use of a given strategy, even if prompted less frequently, substantially intensifies or prolongs unpleasant emotions. Zero or negative correlations may indicate that this maladaptive boosting effect of strategy use on the emotion is weaker than the negative effect of the emotion on strategy use.

In sum, positive and negative correlations between emotions and ER strategies may stem from different patterns of causal linkages, and they may have different implications for positive versus negative emotions, which underscores the need for more research examining linkages over time (see Study 3). We build on this blueprint for interpreting correlational evidence in reviewing past research on ER in academic settings.

1.2.3.1. Achievement emotions. Students' efforts for managing achievement emotions should be linked to their emotional experiences. As noted above, linkages are likely bidirectional in nature: Emotions can influence whether and how students regulate their emotions, and these strategies, in turn, should impact how they feel. Evidence for this assumption can be garnered from non-educational research on reciprocal effects between negative affect and ER strategy use over time (Wang et al., 2024), which points to reinforcing feedback loops between negative emotions and avoidance-focused strategies. Specifically, the authors found that higher levels of negative affect lead to stronger reliance on avoidance-focused ER strategies, and that the use of these strategies, in turn, leads to higher levels of subsequent negative affect.

Positive emotions, in contrast, and activating ones such as enjoyment in particular, may equip individuals with energetic resources and approach-oriented tendencies that facilitate use of strategies that require active problem-solving, effort, and persistence, such as reappraisal or competence development strategies (Ford & Troy, 2019). From a broaden-and-built theoretical perspective (Fredrickson, 2001), positive

emotions may be particularly beneficial for these strategies because they promote cognitive flexibility, broaden attention, and drive individuals to derive positive meaning. On the other hand, negative emotions promote cognitive rigidity and facilitate detection as well as activation of negatively valenced information in immediate surroundings or memory, respectively (see review in Pekrun et al., 2023). The implementation of regulatory strategies should impact subsequent emotions as well: To the extent that students' regulation is driven by prohedonic goals and executed effectively, they can serve to upregulate positive and downregulate negative emotions.

Prior research on university students' use of ER strategies does point to systematic links with mood and emotions. For example, Rottweiler et al. (2018) found that students' suppression of exam-related anxiety immediately improved their mood, whereas use of reappraisal, distraction, and emotional expression had no impact. Balzarotti, Chiarella, and Ciceri (2017), in contrast, found that individual differences in students' habitual use of cognitive reappraisal prior to an upcoming exam predicted higher levels of positive and lower levels of negative affect. Similarly, Harley, Jarrell, and Lajoie (2019) reported positive links between medical students' habitual use of reappraisal and self-reported pride in a diagnostic reasoning task, whereas use of suppression predicted anxiety, shame, and hopelessness. Their findings partly align with those reported by Burić et al. (2016), who found that habitual use of suppression of negative affect is positively associated with negative achievement emotions. Considering the cross-sectional nature of their study, this suggests that negative emotions may drive students towards using suppression, but also that suppression may boost negative achievement emotions. Students' enjoyment was also positively associated with suppression of negative affect; reappraisal, in contrast, was positively related with pride, anxiety, anger, and boredom.

In line with the present research, Burić et al. (2016) also examined students' use of situational avoidance, competence development, and social support seeking for regulating negative affect. Whereas social support seeking was positively associated with both positive achievement emotions and anxiety, but unrelated to boredom or hopelessness, use of competence development strategies was positively related to positive achievement emotions, and negatively to anger, boredom, and hopelessness but not anxiety. Situational avoidance, in contrast, was negatively related to hope and pride, but not enjoyment, and positively to negative achievement emotions. In interpreting these findings, it is important to note that the authors focused on strategies for managing negative rather than positive affect. To gain deeper insight into linkages between emotions and emotion regulation, it may be helpful to align measures and consider strategies for regulating specific positive and negative emotions.

1.2.3.2. Well-being and health. How students regulate their emotions may also be reciprocally linked to their academic well-being. Supporting evidence is scarce, but a recent study involving secondary school students found that their habitual use of reappraisal positively predicted subsequent school-related well-being, and well-being positively predicted subsequent use of reappraisal (Beaumont et al., 2023). While mechanisms driving these relations were not tested, they may in part be attributable to a positive impact of reappraisal on students' achievement emotions, which can contribute to their well-being; in other words, more frequent use of reappraisal strategies promoted students' subsequent well-being, whereas less frequent use of reappraisal was linked to lower well-being, relatively speaking. Higher well-being, in turn, may be conducive to more positive evaluations of the self or external situations, similar to effects of positive emotions on the subsequent use of reappraisal strategies. Accordingly, students with higher well-being may use this strategy more frequently to maintain high levels of positive emotions and well-being over time.

Interestingly, habitual suppression and well-being were not related in Beaumont et al.'s (2023) study, which contradicts prior research

suggesting that frequent reliance on this strategy can undermine well-being and amplify negative emotions (Gross, 2015). Seibert, Bauer, May, and Fincham (2017) found habitual use of reappraisal to negatively, and suppression to positively predict subsequent levels of school burnout. Furthermore, using a standardized stress induction paradigm and lab setting, Griffin and Howard (2022) found that habitual use of suppression is associated with exaggerated blood pressure, and reappraisal with more adaptive cardiovascular responding for a subset of stressors considered. However, other studies indicate that suppression can have short-term benefits for mood (Le & Impett, 2013; Rottweiler et al., 2018).

The importance of better understanding of linkages between ER and well-being is also underscored by research indicating that emotions themselves matter for student well-being and health. Past research on test anxiety has linked this emotion to elevated cortisol levels indicating stress, sleep problems, cardiovascular processes, or reduced immune system functioning (Conley & Lehman, 2012; Dewald, Meijer, Oort, Kerkhof, & Bögels, 2014; Ringeisen, Lichtenfeld, Becker, & Minkley, 2019) implying that this emotion can pose a severe threat to students' health. Corroborating these findings, Pekrun et al. (2023) found that university students' achievement-related anxiety was positively related to somatic complaints and health problems including headaches, stomach pain, and sleep problems. Boredom was also substantially related to higher levels of health problems, aligning with a recent study by Schwartze et al. (2021), which linked university students' boredom to their physical and psychological well-being. Enjoyment, in contrast, may be negatively related to health problems in university students (Pekrun et al., 2023). As such, while positive achievement emotions may promote student well-being—or at least help to reduce health problems—, negative achievement emotions such as anxiety and boredom can put individuals at risk for health problems and ill-being.

1.2.3.3. Learning and academic achievement. To the extent that students' ER impacts their emotions and academic well-being, it should also influence their resources for learning, their investment of effort, and, by implication, achievement outcomes. Conversely, varying levels of academic success are linked to different experiences of achievement emotions and levels of well-being, which, in turn, shape ER. As summarized by Pekrun et al. (2023; Frenzel et al., 2024), emotions impact students' academic performance, with positive net effects emerging for positive activating emotions such as enjoyment, and negative effects for anxiety and boredom. Moreover, achievement also impacts subsequent emotions, resulting in positive feedback loops for positive emotions, and negative loops for negative emotions. Academic achievement can thus theoretically be viewed as a distal antecedent and outcome of achievement emotion regulation. Empirical evidence is virtually nonexistent, however.

Past debates on the impact of different ER strategies on cognitive performance have mostly focused on reappraisal and suppression. As summarized by Rottweiler et al. (2023), use of reappraisal can have beneficial outcomes on learning and performance (Balzarotti et al., 2017; Brady, Hard, & Gross, 2018; Davis & Levine, 2013; Jarrell, Lajoie, Hall, & Horrocks, 2022), although this strategy can be cognitively taxing (Ford & Troy, 2019). Inhibiting emotions via habitual suppression, too, may put a strain on cognitive resources (Dillon, Ritchey, Johnson, & LaBar, 2007) and seems to be associated with negative achievement consequences (see also Frenzel et al., 2024).

For strategies beyond reappraisal and suppression, evidence is scarce. Considering that competence development strategies may be particularly conducive to students' achievement, and higher levels of prior achievement should boost positive emotions and dampen negative emotions, it is plausible to assume positive feedback loops for this strategy. For situation selection, in contrast, which can entail skipping class or procrastinating, negative links may be expected. Initial evidence is provided by Burić et al. (2016), who found that using competence

development to manage negative affect was positively, and situational avoidance negatively associated with achievement from a cross-sectional perspective.

1.2.3.4. Demographic and contextual factors. Students' ER is likely also shaped by individual demographic characteristics as well as the socio-cultural (academic) contexts they are surrounded by. Gender may constitute one important source of individual differences in regulatory habits targeting achievement emotions. On the one hand, domain-specific gender stereotypes may impact the relative experience of positive and negative emotions of female versus male students (e.g., Frenzel et al., 2024); on the other, gender stereotypes targeting how male and female individuals regulate their emotions may impact students' behaviors. This may be particularly true for strategies that pertain to outward communication of emotions, that is, expression, suppression, and social support seeking. Based on past research, it is possible that female students engage in more expression and social support seeking, and male students in more suppression (Gross, 2015; McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008).

Partially aligning with this assumption, Burić et al. (2016) found that female Croatian university students report seeking social support more frequently than male students. However, females also reported using more competence development, reappraisal, and suppression, implying they generally engaged in more emotional self-regulation. As gender norms regarding emotions and ER may also vary across social contexts and cultures (e.g., Mesquita & Schouten, 2024), more research is needed to examine strategy use among students of different genders in different academic contexts. Moreover, higher education systems differ in important ways across countries, including European countries such as Germany and Europe (e.g., Hüther & Krücken, 2018). These differences span administrative and organizational characteristics, admission processes, the composition of student populations, tuition fees, and even instructional policies and assessment practices, among other factors, which make for different academic landscapes students have to navigate emotionally. To our knowledge, contextual influences on students' ER have not been studied to date. In this research, we take a first step in this direction and examine regulatory behaviors of German and English university students.

1.2.4. Summary

Taken together, prior theorizing and research suggest that students can deploy a multitude of strategies to regulate their emotions, some of which may be relatively unique to achievement settings (e.g., *competence development* strategies). However, past inquiry into habitual ER tendencies has predominantly focused on the use of reappraisal versus suppression strategies, as well as their antecedents and outcomes (Frenzel et al., 2024). As delineated above, students' habits for regulating achievement emotions should be systematically linked not only to their emotional experiences at university, but also to their academic well-being, health, and academic achievement (Fig. 1). Extrapolating from evidence currently available, it is plausible to assume that habitual use of reappraisal may be particularly beneficial for upregulating positive and downregulating negative emotions, as well as for promoting well-being, health, and achievement which, in turn, should boost habitual reliance on reappraisal strategies over time. For the remaining strategies, evidence is either inconsistent (e.g., emotional suppression) or lacking altogether, particularly in educational settings. Moreover, it is largely unclear to which degree habitual patterns of strategy use differ across students' genders or the academic contexts they encounter.

2. Overview of the present research

University students are widely expected to take charge of their learning and to become competent self-regulators. Nevertheless, we know little about how students go about managing their achievement

emotions, let alone how these efforts relate to their well-being and health. To help better understand university students' ER, we conducted three empirical studies involving samples from two countries (Germany and England). Grounded in established theories and expanding upon prior research (Gross, 2015; Harley, Pekrun, et al., 2019; Pekrun & Stephens, 2009; Rottweiler et al., 2023), we included six potentially important strategies for managing achievement emotions that cover frequently considered (i.e., *reappraisal*, *suppression*) as well as relatively understudied strategies (i.e., *situation selection*; *social support seeking*; *expression of emotion*; *competence development*). Students' tendencies to use these strategies were assessed using a contextualized and emotion-specific instrument that includes separate scales for these strategies for regulating achievement-related enjoyment, anxiety, and boredom at university.

Studies 1 and 2 served to examine the structural validity and interrelations among the ER scales to (1) ensure that the six strategies represent separable constructs, and (2) investigate whether corresponding strategies targeting the regulation of different emotions are sufficiently distinct to warrant emotion-specific strategy measures. We also examined core proximal and distal correlates of students' achievement emotion regulation (Fig. 1; see also Study 1 introduction) and checked for convergent and discriminant relations with domain-general measures of habitual ER. As Studies 1 and 2 were parallel in the constructs and relations assessed but drew on samples of German and English university students, respectively, we provide initial insight into similarities in students' achievement emotion regulation across different academic contexts. Study 3 focused on German university students and sought to verify the findings from Studies 1 and 2. Furthermore, it employed a five-wave prospective design spanning one semester to examine relations among students' use of ER strategies with prior as well as subsequent emotions, academic well-being, and health, and probed relations with end-of-semester test performance.

Taken together, the studies cover new ground targeting university students' emotional self-regulation by considering strategies that have received little attention to date, and by focusing on regulating both positive and negative emotions using an emotion-specific assessment tool. Moreover, we examine relations between ER and academic well-being, which has been the source of increasing concern among policy makers and practitioners, and explore links with domain-general physical health, which has been neglected in prior work.

3. Study 1

Study 1 investigated the structure, use, and correlates of ER strategies in academic university settings. Using a newly developed Regulation of Achievement Emotions Questionnaire (RAEQ), we examined all six strategies outlined in our theoretical model (Fig. 1), targeting self-regulation of achievement-related enjoyment, anxiety, and boredom. Participants were German university students. We used confirmatory factor analysis (CFA), exploratory structural equation modeling (ESEM), and correlational analyses to test the structure of the instrument, including interrelations among different strategies. We expected the scales to represent separable but related constructs. Moreover, we expected corresponding strategy scales across emotions (e.g., regulating enjoyment vs. anxiety via reappraisal) to be related but sufficiently distinct to warrant emotion-specific analyses of ER.

Next, we examined relations between strategy use and correlates representing potential antecedents and outcomes of self-regulation. Due to the cross-sectional nature of the data, we focused on correlational links. We expected students' ER to be systematically related to their achievement emotions, as students' emotions should impact their use of regulatory strategies and, conversely, students' strategies should impact their emotions (see section 1.2.3). Similarly, we explored relations with perceived regulatory effectiveness to see whether strategies are differentially related to students' sense of effectiveness for managing their own emotions. We also hypothesized students' ER to be associated with

their well-being at university, explored whether regulatory efforts related to the experience of health problems, and whether emotional self-regulation is linked to students' achievement.

To further probe the relevance of contextualizing measures of ER, we also examined relations between ER strategies used for managing achievement emotions with the general use of reappraisal and suppression strategies in daily life. We expected associations to be strongest for the corresponding *reappraisal* and *suppression* scales targeting regulation of achievement emotions, compared to the remaining scales. Nevertheless, we expected the relations to reflect discriminant validity of these constructs. Stated differently, we expected that context-specific and domain-general regulatory efforts are related but separable.

Finally, we explored relations between ER and students' gender. We

expected that *expression* and *social support seeking* may be more frequent among female students, male students might engage in more *suppression*.

3.1. Method

3.1.1. Sample and procedure

Participants were 350 students ($M_{\text{age}} = 22.24$ years, $SD = 4.11$; 287 [82.0%] female, 58 [16.6%] male, 1 [.30%] non-binary, 4 [1.10%] gender not reported) enrolled at a large research university in Germany. Most students ($N = 319$; 91.1%) reported that German was their native language. They were enrolled in various programs including teacher education ($N = 110$; 31.5%), psychology ($N = 91$; 26.0%), natural sciences and mathematics ($N = 17$; 4.9%), language arts or foreign

Table 1
Descriptive statistics for emotion regulation scales in Studies 1–3.

Strategy (No. of items)	Study	<i>M</i>	<i>SD</i>	Skewness	Kurtosis	<i>M</i> $r_{i(i-1)}$	α
<i>Regulating Enjoyment</i>							
Situation selection (3)	1	1.95	.87	.77	-.07	.59	.74
	2	3.31	.96	-.36	-.22	.48	.66
	3	1.62	.75	1.26	1.09	.73	.86
Social support seeking (4)	1	3.63	.88	-.76	.21	.62	.80
	2	3.11	1.09	-.16	-.81	.65	.82
	3	2.79	.99	-.05	-.93	.71	.86
Reappraisal (7)	1	3.65	.70	-.56	.48	.53	.80
	2	3.35	.98	-.24	-.54	.67	.88
	3	3.42	.62	-.18	-.32	.46	.74
Expression (4)	1	3.52	.76	-.33	-.02	.53	.73
	2	3.21	1.06	-.06	-.78	.63	.81
	3	2.92	.89	-.28	-.38	.67	.83
Suppression (5)	1	2.01	.77	.52	-.42	.67	.86
	2	2.41	1.10	.54	-.64	.74	.89
	3	2.27	.81	.47	.12	.62	.82
Competence development (3)	1	3.59	.89	-.43	-.44	.62	.78
	2	3.79	.95	-.65	-.08	.69	.83
	3	3.48	.75	-.45	.35	.57	.74
<i>Regulating Anxiety</i>							
Situation selection (5)	1	2.18	.88	.85	.52	.62	.82
	2	2.51	1.03	.45	-.59	.55	.78
	3	2.45	.93	.50	-.42	.67	.85
Social support seeking (5)	1	2.75	.83	.13	-.39	.48	.72
	2	2.87	1.05	.03	-.83	.61	.82
	3	2.99	.82	-.27	.00	.53	.76
Reappraisal (6)	1	3.75	.76	-.79	.96	.61	.83
	2	3.32	1.03	-.21	-.73	.69	.88
	3	3.50	.75	-.48	.63	.59	.82
Expression (3)	1	2.52	.87	.36	-.20	.55	.73
	2	2.51	1.11	.40	-.75	.64	.80
	3	2.59	.94	.22	-.36	.63	.78
Suppression (5)	1	3.12	.83	-.13	.19	.61	.82
	2	2.96	1.00	.09	-.49	.64	.84
	3	2.93	.79	.19	.05	.59	.81
Competence development (4)	1	3.53	.80	-.34	-.36	.42	.64
	2	3.37	1.04	-.34	-.67	.63	.81
	3	3.54	.82	-.50	-.01	.60	.78
<i>Regulating Boredom</i>							
Situation selection (4)	1	2.03	.96	.04	-.67	.55	.75
	2	2.96	1.11	.07	-.80	.65	.81
	3	2.94	.85	.11	-.54	.56	.76
Social support seeking (4)	1	3.27	.89	-.42	-.04	.55	.75
	2	2.83	1.04	.18	-.68	.58	.77
	3	3.09	.88	-.26	-.08	.55	.75
Reappraisal (5)	1	3.27	.77	-.31	.09	.57	.79
	2	3.19	1.04	-.14	-.67	.69	.87
	3	3.51	.70	-.48	.77	.59	.80
Expression (4)	1	2.73	.78	.07	-.28	.52	.73
	2	2.72	1.02	.18	-.62	.57	.74
	3	2.19	.77	.45	-.44	.51	.72
Suppression (5)	1	2.66	.79	.14	.08	.65	.83
	2	2.60	.92	.28	-.44	.60	.81
	3	3.02	.73	-.06	-.01	.56	.78
Competence development (4)	1	3.27	.79	-.13	-.31	.68	.74
	2	3.02	1.01	-.06	-.70	.60	.79
	3	3.42	.72	-.26	.06	.55	.75

language studies ($N = 17$; 4.9%), medicine ($N = 16$; 4.6%), and other fields. Most were enrolled in their second to fourth semester ($N = 236$; 67.4%; range = 1 to 12 semesters; $N = 9$ [2.6%] first-semester students). Ethics approval was obtained from the institution's ethics committee. Students were recruited via a university mailing list. Participation was voluntary, and students provided informed consent prior to the study. They received course credit or monetary compensation (10 €) for completing the web-based survey.

3.1.2. Measures

3.1.2.1. Emotion regulation strategies. We used the RAEQ to assess ER strategies. The instrument measures students' use of *situation selection*, *social support seeking*, *reappraisal*, *expression*, *suppression*, and *competence development* for regulating achievement-related enjoyment, anxiety, and boredom in their university studies. Accordingly, the RAEQ comprises 18 subscales (3 emotions; 6 strategies per emotion) and focuses on students' self-regulation of emotions.

In keeping with extant instruments, we designed the RAEQ to assess prohedonic regulation tied to maximizing pleasant and minimizing unpleasant emotions (e.g., Carver, 1997; Gross & John, 2003). The items were partly derived from existing instruments (Burić et al., 2016; Nett, Götz, & Krannich, 2018), but also include newly developed items derived from our theoretical framework. Similar to the Academic Emotion Regulation Questionnaire (AERQ) developed by Burić et al. (2016), we took a contextualized approach to measuring ER by focusing specifically on emotions experienced in relation to studying, attending class, or taking tests at university. However, we provide separate scales for three achievement emotions, including one positive and two negative emotions, rather than focusing solely on the downregulation of global negative affect. Consequently, items were formulated in an emotion-specific manner. For example, the *reappraisal* scale for anxiety included reappraising the value of achievement ("To calm down when I am nervous during studying, I remind myself that there are more important things in life"), whereas the value-focused *reappraisal* items for regulating enjoyment and boredom focused on increasing perceived value of learning materials. We also constructed items involving reappraisal of perceived competence and control over learning, which is a core determinant of achievement emotions but not explicitly included in the AERQ. Moreover, in line with our theoretical framework, we expanded the set of previously examined ER strategies in academic settings to include competence development as a major strategy. All items, instructions, and further details on the instrument are provided in the supplementary materials.

Items are answered on a five-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Based on initial item analyses (Stockinger, Pekrun, Schreyer, Kitzmann, & Vogl, 2022) and removal of items with low item-total correlations, the RAEQ contains 3 to 7 items per subscale (see Table 1) and a total of 80 items across all 18 scales. Mean alpha was .77 (Table 1). Because all main analyses were conducted on a latent level to account for measurement error, we considered reliability as acceptable.

3.1.2.2. Achievement emotions. We measured students' achievement-related enjoyment (6 items: e.g., "I enjoy doing my assignments"; $\alpha = .85$), anxiety (12 items; e.g., "I worry I might fail"; $\alpha = .94$), and boredom (7 items; e.g., "My assignments bore me to death"; $\alpha = .89$) at university (i.e., when attending class, studying, or taking tests) using the German scales of the revised Achievement Emotions Questionnaire (AEQ-R; Pekrun et al., 2023). Participants responded on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*).

3.1.2.3. Perceived regulatory effectiveness. We measured students' perceived regulatory effectiveness with one item per emotion. The items asked students to indicate, on a five-point scale ranging from (1) *not at*

all to (5) *very*, to what degree they perceived themselves able to influence their enjoyment, anxiety, or boredom, respectively, at university. In keeping with prior research on students' motivational self-regulation (Engelschall et al., 2016; von der Mülbe, Rinas, Dresel, & Stockinger, 2024), these items tap into the degree to which students perceive themselves as able to overcome their regulatory problems and achieve their regulatory goals.

3.1.2.4. Academic well-being. Students' well-being was assessed using an adapted version of the school-related well-being scale (SWBS; Stockinger, Vogl, & Pekrun, 2023). The scale contains six items covering students' cognitive and affective evaluations of their overall well-being at university (e.g., "I feel comfortable at university"; $\alpha = .87$). The scale has been used in several studies involving elementary and secondary school from different socio-cultural backgrounds (see Stockinger et al., 2023) which attest to its reliability and structural validity, and show that it meaningfully predicts a number of important student outcomes. Participants responded on a 5-point Likert-type scale (1 = *strongly disagree* to 5 = *strongly agree*).

3.1.2.5. Health problems. We assessed general experiences of health problems using a 10-item scale employed by Pekrun et al. (2023), which is grounded in the Patient Health Questionnaire (PHQ-15; Kroenke, Spitzer, & Williams, 2002). On a scale ranging from 1 (*never*) to 5 (*daily*), students report how frequently they experience symptoms such as stomach, back, or sleep problems, headaches, heart pounding or racing, and tiredness, over the past weeks ($\alpha = .82$).

3.1.2.6. Academic achievement. Students reported their current grade averages based on their last transcript of records. In Germany, grades range from 1 (*very good*) to 6 (*insufficient/failing grade*). For ease of interpretation, grades were inverted prior to analysis.

3.1.2.7. Domain-general emotion regulation. We assessed students' general use of reappraisal (6 items; $\alpha = .85$; sample item: "When I want to feel less negative emotion, I change the way I'm thinking about the situation") and suppression (4 items; $\alpha = .83$; sample item: "I keep my emotions to myself") to regulate emotions in daily life using the German version of Gross and John's Emotion Regulation Questionnaire (Ablert & Kessler, 2009). Items were assessed on a 7-point Likert-scale (1 = *not at all true* to 7 = *completely true*).

3.2. Results and discussion

Data and syntax used in this study and Studies 2 and 3 are available via OSF (<https://osf.io/2rhdt/>).

3.2.1. Score distributions of RAEQ scales

Descriptive statistics for the ER scales are provided in Table 1. The mean scores suggest that university students use all 18 strategies, but also that they are used to varying degrees as reflected in the variances. Some strategies may generally be used more than others: Across all three emotions, *situation selection* was least commonly reported, relative to the other strategies considered. *Reappraisal* and *competence development* were consistently more common. For some strategies, mean scores also differed across emotions: *Social support seeking* was more common for regulating enjoyment and boredom as compared with anxiety, while emotional *expression* was more common for enjoyment. These findings suggest that students' ER can involve a variety of strategies, and strategy use can vary between individuals, but also with regard to the to-be-regulated emotion.

3.2.2. Structural validity

3.2.2.1. Confirmatory factor analysis. We tested the dimensionality of

each RAEQ scale using CFA with Mplus 7 (Muthén & Muthén, 1998-2012). For scales containing four or more items, we included correlated residuals for items with parallel or similar wording and for conceptually related items, such as items reflecting reappraisals of either perceived control or perceived value for the reappraisal scales. We included the same correlations between residuals across Studies 1 to 3. We employed the robust maximum likelihood estimator (MLR), which is robust to nonnormality of observed variables. There were no missing data for the RAEQ scales. We evaluated model fit using the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root-mean-square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). As RMSEA and TLI may be biased in models with few degrees of freedom, we relied on this index for models with five or more degrees of freedom only (Kenny, Kaniskan, & McCoach, 2015). Values of CFI and TLI above .90/close to .95, values of RMSEA and SRMR below .10/close to .06 have traditionally been considered as indicative of acceptable/good model fit, respectively (Hu & Bentler, 1999). However, these cutoff criteria stem from simulated data and should be used cautiously (Marsh, Hau, & Wen, 2004).

The CFAs fit the data well, with CFIs $\geq .95$, TLIs $\geq .90$ (where applicable), RMSEAs $\leq .09$ (where applicable), and SRMRs $\leq .04$ for all scales (see Table S1 in supplementary materials). These findings suggest that all 18 ER scales can be modeled well using CFA.

3.2.2.2. Correlations between RAEQ scales. We estimated correlations between all 18 ER scales (i.e., across strategies and emotions) using

factor scores derived from the individual CFAs. According to the factor determinacy indexes for these scores, loss of precision due to using these scores was acceptable (all $\geq .82$, see supplemental Table S1; see Table S2 for correlations). Correlations were disattenuated using McDonald's ω derived from the CFAs (see Table S1) to avoid underestimation of relations.

All 306 disattenuated correlations were $r \leq .74$, and 288 (94.1%) were $\leq .50$, indicating that the scales assess empirically separable constructs. This includes both correlations between corresponding strategies across emotions (enjoyment, anxiety, boredom) as well as scales representing different ER strategies. Correlations between corresponding strategies across emotions were all positive, as can be expected, but speak to the discriminant validity, supporting the emotion-specific approach to assessing ER.

In terms of correlations between different strategies, we found that *social support seeking* and *expression* were positively related for all three emotions, which is likely attributable to the social-communicative consequences expression may share with seeking support from others. *Reappraisal* and *competence development* were positively related—but distinguishable—across all three emotions. In contrast, *expression* and *suppression* were consistently negatively related. Overall, the correlations document sufficient independence of the RAEQ scales.

3.2.2.3. Exploratory structural equation modeling. We further examined the underlying factorial structure of the RAEQ using exploratory structural equation modeling (ESEM) which accounts for potential cross-

Table 2
Latent correlations of emotion regulation strategies with achievement emotions in Studies 1 and 2.

	Study	Enjoyment	Anxiety	Boredom
<i>Regulating Enjoyment</i>				
Situation selection	1	-.12 (.07)	.28 (.06)	.36 (.08)
	2	.22 (.06)	.09 (.06)	.04 (.06)
Social support seeking	1	.19 (.07)	-.03 (.07)	-.10 (.07)
	2	.48 (.06)	-.04 (.07)	-.11 (.07)
Reappraisal	1	.58 (.07)	-.33 (.06)	-.25 (.08)
	2	.62 (.05)	-.05 (.07)	-.16 (.07)
Expression	1	.25 (.07)	-.09 (.06)	-.13 (.07)
	2	.47 (.06)	.05 (.07)	-.04 (.07)
Suppression	1	-.15 (.07)	.20 (.06)	.29 (.06)
	2	.05 (.07)	.12 (.06)	.20 (.06)
Competence development	1	.40 (.08)	-.11 (.07)	-.19 (.08)
	2	.46 (.05)	.05 (.07)	-.32 (.06)
<i>Regulating Anxiety</i>				
Situation selection	1	-.24 (.07)	.41 (.06)	.40 (.08)
	2	-.35 (.07)	.49 (.05)	.44 (.06)
Social support seeking	1	-.07 (.08)	.23 (.07)	.20 (.07)
	2	.19 (.07)	.25 (.07)	.21 (.07)
Reappraisal	1	.26 (.07)	-.20 (.07)	-.17 (.07)
	2	.39 (.06)	-.15 (.06)	-.12 (.07)
Expression	1	-.11 (.07)	.28 (.06)	.08 (.07)
	2	.19 (.07)	.15 (.07)	.14 (.06)
Suppression	1	.19 (.08)	-.14 (.08)	-.09 (.07)
	2	.14 (.07)	.06 (.07)	.09 (.07)
Competence development	1	.38 (.07)	-.25 (.07)	-.28 (.07)
	2	.52 (.05)	-.10 (.07)	-.23 (.07)
<i>Regulating Boredom</i>				
Situation selection	1	-.26 (.06)	.41 (.06)	.48 (.05)
	2	-.42 (.06)	.24 (.06)	.48 (.06)
Social support seeking	1	.09 (.08)	.03 (.07)	.09 (.07)
	2	.19 (.07)	.10 (.07)	.21 (.07)
Reappraisal	1	.43 (.07)	-.19 (.07)	-.20 (.07)
	2	.46 (.06)	-.03 (.06)	-.21 (.07)
Expression	1	-.07 (.07)	.18 (.07)	.31 (.07)
	2	.10 (.07)	.04 (.07)	.32 (.07)
Suppression	1	.16 (.06)	-.02 (.06)	-.15 (.07)
	2	.27 (.07)	.07 (.07)	-.08 (.07)
Competence development	1	.37 (.07)	-.19 (.07)	-.28 (.08)
	2	.60 (.05)	-.06 (.07)	-.24 (.07)

Note. Coefficients are latent correlations. Standard errors are reported in parentheses. **Bold** coefficients: $p < .05$.

loadings of items on conceptually related factors, in contrast to traditional CFA which constrains cross-loadings of items on non-target factors to zero. As such, ESEM aligns with our assumption that the ER scales capture separable but related categories of regulatory behaviors, and has generally been found to allow for more realistic estimation of relations between constructs (Marsh, Morin, Parker, & Kaur, 2014). To avoid convergence problems, we computed separate models for each emotion. We estimated parameters using the MLR estimator and target rotation. Each model included separate factors representing the six strategies and included the same correlations between residuals as the single-scale CFAs. The emotion-specific models showed a good to acceptable fit to the data, with CFIs $\geq .94$, TLIs $\geq .90$, RMSEAs $\leq .05$, and SRMRs $\leq .03$ (see Table S3). These findings support the overall structural validity of the RAEQ.

3.2.3. Correlates

In this section, we report findings for relations between students' ER and correlates. In interpreting effect sizes, we adopted the empirically grounded benchmarks proposed by Gignac and Szodorai (2016), who suggest considering $r = .10$, $.20$, and $.30$ for manifest correlations, as well as $\rho = .15$, $.25$, and $.35$ for latent correlations, as reflecting small, moderate, and strong effects, respectively.

3.2.3.1. Achievement emotions. We examined latent correlations between ER strategies with achievement emotions using latent correlation

models. We computed three separate models for regulating enjoyment, anxiety, and boredom. Each model contained the six regulatory strategies assessed and the three achievement emotions, all modeled as latent variables (see Table S4 for CFAs of the achievement emotion scales).

Most strategies were significantly related to their target emotion (small to large effects; Table 2). Linkages with *reappraisal* and *competence development* were most pronounced for all three emotions. For enjoyment, these relations were positive. While different causal mechanisms may be driving these cross-sectional relations (see section 1.2.3), one interpretation of this finding may be that students who experience more enjoyment, on average, rely on these strategies more frequently to upregulate or maintain high levels of enjoyment in their studies. Additionally, these strategies likely impact subsequent levels of enjoyment, and higher initial levels thereof may be particularly helpful for executing these strategies effectively (see 1.2.3.1) to sustain or even increase enjoyment over time. For anxiety and boredom, relations with these strategies were negative, implying that *reappraisal* and *competence development* can be associated with lower levels of these unpleasant emotions or, conversely, that students with higher levels of anxiety and boredom rely on these cognitively taxing strategies less frequently. Furthermore, *expression* was positively related to enjoyment, anxiety, and boredom, suggesting that this strategy can be prompted by, and/or serve to intensify both positive and negative emotions and may not necessarily promote relief from unpleasant emotions. Use of *suppression*, in contrast, was negatively related to all three emotions.

Table 3

Latent correlations of emotion regulation strategies with perceived effectiveness, well-being, health problems, academic success, and gender in Studies 1 and 2.

Regulation Strategy	Study	Perceived Regulatory Effectiveness	Academic Well-Being	Health Problems	Academic Success ^a	Gender
<i>Regulating Enjoyment</i>						
Situation selection	1	-.19 (.06)	-.25 (.07)	.16 (.07)	-.17 (.07)	-.05 (.07)
	2	.08 (.06)	.13 (.08)	-.04 (.07)	.06 (.06)	.03 (.06)
Social support seeking	1	.19 (.06)	.38 (.06)	-.10 (.08)	.01 (.06)	.13 (.06)
	2	.21 (.06)	.33 (.08)	.11 (.07)	.21 (.07)	-.09 (.06)
Reappraisal	1	.52 (.05)	.55 (.06)	-.26 (.07)	.21 (.06)	-.01 (.07)
	2	.28 (.06)	.37 (.08)	-.04 (.07)	.28 (.06)	-.06 (.06)
Expression	1	.23 (.06)	.35 (.06)	-.05 (.08)	-.06 (.06)	.14 (.06)
	2	.26 (.06)	.36 (.08)	.04 (.06)	.20 (.06)	-.05 (.06)
Suppression	1	-.19 (.06)	-.25 (.07)	.13 (.07)	.02 (.06)	-.27 (.10)
	2	-.06 (.06)	-.09 (.08)	.16 (.06)	-.13 (.06)	-.04 (.06)
Competence development	1	.21 (.06)	.34 (.07)	-.11 (.07)	.28 (.06)	.02 (.07)
	2	.22 (.07)	.40 (.08)	.04 (.07)	.28 (.06)	.08 (.06)
<i>Regulating Anxiety</i>						
Situation selection	1	-.32 (.05)	-.39 (.06)	.23 (.07)	-.31 (.06)	-.07 (.06)
	2	-.38 (.06)	-.38 (.08)	.42 (.06)	-.38 (.06)	.02 (.06)
Social support seeking	1	.01 (.07)	.11 (.08)	.08 (.07)	-.08 (.06)	.20 (.06)
	2	.00 (.07)	.11 (.08)	.26 (.06)	.03 (.06)	-.01 (.06)
Reappraisal	1	.30 (.06)	.33 (.07)	-.28 (.06)	.24 (.06)	.12 (.06)
	2	.32 (.06)	.35 (.07)	-.11 (.06)	.32 (.06)	.02 (.06)
Expression	1	-.07 (.07)	.05 (.07)	.16 (.07)	-.05 (.07)	.20 (.06)
	2	.09 (.07)	.06 (.08)	.19 (.06)	.04 (.06)	-.06 (.06)
Suppression	1	.30 (.04)	.12 (.07)	-.17 (.07)	-.06 (.06)	-.15 (.06)
	2	.12 (.07)	-.00 (.08)	.08 (.06)	-.00 (.06)	-.05 (.06)
Competence development	1	.14 (.08)	.38 (.06)	-.24 (.07)	.30 (.06)	.14 (.07)
	2	.31 (.06)	.45 (.08)	-.08 (.06)	.33 (.07)	.04 (.06)
<i>Regulating Boredom</i>						
Situation selection	1	-.37 (.06)	-.29 (.07)	.24 (.07)	-.23 (.06)	-.03 (.06)
	2	-.31 (.06)	-.24 (.09)	.17 (.07)	-.21 (.06)	-.03 (.06)
Social support seeking	1	-.03 (.07)	.23 (.08)	.01 (.07)	.05 (.08)	.21 (.06)
	2	-.03 (.07)	.08 (.09)	.22 (.07)	.09 (.06)	-.10 (.06)
Reappraisal	1	.27 (.07)	.39 (.07)	-.19 (.07)	.01 (.06)	.01 (.07)
	2	.28 (.06)	.26 (.09)	-.01 (.06)	.13 (.07)	-.02 (.06)
Expression	1	-.29 (.07)	-.00 (.08)	.20 (.08)	.01 (.08)	.08 (.07)
	2	-.05 (.07)	.13 (.10)	.25 (.07)	.06 (.07)	-.08 (.07)
Suppression	1	.27 (.06)	.09 (.06)	-.06 (.08)	-.03 (.07)	-.06 (.05)
	2	.20 (.07)	.15 (.08)	.07 (.07)	.09 (.07)	-.09 (.06)
Competence development	1	.40 (.06)	.35 (.07)	-.18 (.07)	.05 (.06)	-.03 (.06)
	2	.42 (.07)	.38 (.08)	.11 (.07)	.22 (.06)	-.03 (.06)

Note. Gender was coded 1 = male, 2 = female. Coefficients are latent correlations. Standard errors are reported in parentheses. **Bold** coefficients: $p < .05$.

^a Study 1: Self-reported current academic grade-point average at the time of data collection. Study 2: Perceived academic success in current academic year (10-point scale, 1 = *very unsuccessful*, 10 = *very successful*).

For *situation selection* and *social support seeking*, relations with target emotions were more variable. Managing anxiety and boredom via *situation selection* was positively and strongly related to these emotions, but for enjoyment, there was no substantial link. This suggests that students who draw more heavily on *situation selection* also experience higher levels of anxiety and boredom. *Social support seeking*, in contrast, was positively related to enjoyment and anxiety, but not significantly related to boredom; this raises the question of implementing effective social support systems for university students struggling with this emotion.

Relations between ER strategies with *non-target* emotions also emerged, as is to be expected given that achievement emotions co-occur and regulating one emotion may influence the experience of other emotions. These relations were generally less pronounced and differed in the expected ways. For instance, some strategies that were positively related to enjoyment were negatively correlated with anxiety and boredom.

Taken together, the findings suggest that ER strategies are meaningfully linked to achievement emotions, and that a deeper understanding of these strategies may benefit from emotion-specific analyses. These cross-sectional linkages are likely driven by reciprocal influences between emotions and regulatory behaviors (see 1.2.3). While strategy use should influence how students feel, their emotions should also shape their efforts to regulate them. For instance, positive relations between enjoyment and reappraisal suggest that reappraisal facilitates enjoyment, but could also indicate that enjoyment is particularly conducive to reappraisal given that enjoyment can promote cognitive flexibility that may be required to execute reappraisal effectively (Ford & Troy, 2019; Wang et al., 2024). Future studies should examine these reciprocal linkages (see 1.2.3).

3.2.3.2. Perceived regulatory effectiveness. We estimated correlations of the RAEQ scales, modeled as latent variables, with students' perceived effectiveness of regulating targeting enjoyment, anxiety, and boredom, modeled as manifest variables (Table 3). For all three emotions, ER strategies were differentially related to students' perceived regulatory effectiveness. *Reappraisal* was positively, and *situation selection* negatively related to effectiveness for all three emotions. *Competence development* was also positively related to effectiveness targeting enjoyment and boredom (for anxiety, the positive correlation was marginally significant). For the remaining strategies, relations varied across emotions. *Social support seeking* was positively associated with effectiveness only for enjoyment. Moreover, *expression* was positively related to regulatory effectiveness for enjoyment, whereas for boredom, a negative association emerged; for *suppression*, the patterns were reversed. *Suppression* was also positively related to regulatory effectiveness for anxiety. As such, in terms of relations with perceived regulatory effectiveness, *expression* and *suppression* may function differently for positive and negative emotions.

3.2.3.3. Academic well-being. We examined links between students' ER and well-being at university. We computed three separate correlation models for regulating enjoyment, anxiety, and boredom. Each model contained the six regulatory strategies and well-being, all modeled as latent variables (see Table S4 for CFA of the well-being scale).

The findings support the assumption that students' ER and academic well-being are substantially linked (Table 3). For three strategies, links with well-being were consistent across all three emotions: Managing emotions via *situation selection* was negatively, and *reappraisal* and *competence development* were positively related to well-being. For *situation selection*, these correlations suggest that regulating enjoyment, anxiety, and boredom by way of procrastinating, postponing exams, or avoiding dull or difficult classes can come at a cost for well-being. *Situation selection* may allow for temporary maintenance of enjoyment, and prevention or alleviation of anxiety and boredom, but can become burdensome in the long run as unavoidable requirements pile up (e.g.,

for graduation purposes). Alternatively, this relation could imply that *situation selection* may drain students' energetic resources, thus, reducing their well-being. For *reappraisal* and *competence development*, the findings can imply that boosting enjoyment via reappraisal may be particularly adaptive. Nevertheless, higher well-being may also be beneficial for using these complex and labor-intensive regulatory strategies by equipping individuals with motivational and energetic resources to implement them (Ford & Troy, 2019; Wang et al., 2024).

For *social support seeking*, *expression*, and *suppression*, the patterns were less pronounced and less consistent. *Social support seeking* for regulating enjoyment and boredom was positively correlated with well-being, whereas the correlation was not significant for regulating anxiety in this way. *Expression* of enjoyment was positively linked with well-being; *expression* of anxiety and boredom was virtually unrelated to students' well-being, however. *Suppression* of enjoyment was negatively related to well-being, and *suppression* of anxiety was positively related with well-being; for boredom, the correlation was not significant. As such, the results may indicate more ambivalent effects of these strategies. For example, expressing positive emotions may be beneficial, whereas overt expression and venting of negative emotions may not. This aligns with our finding that expression can amplify both positive and negative emotions.

3.2.3.4. Health problems. Using latent correlation models, we examined links between ER strategies and their experience of health problems. We estimated separate models for enjoyment, anxiety, and boredom, each containing the six ER strategies and health problems, all modeled as latent variables (see Table S4 for CFA of health problems scale).

Across all three models, health problems correlated negatively with *reappraisal* and *competence development*, and positively with *situation selection* (Table 3). *Social support seeking* was not significantly related to health problems for any of the three emotions. Aligning with the findings for well-being, the results imply that using reappraisal and competence development may contribute to buffering health problems and/or, vice versa, that students with fewer somatic complaints may more readily rely on these strategies. For *situation selection* involving procrastination or avoidance of undesirable situations, the opposite may be the case.

Expression of anxiety and boredom was associated with higher levels of health problems, pointing to potential negative side effects of this strategy. In contrast, *suppression* of anxiety, interestingly, was associated with lower levels of health problems in this sample. This aligns with prior research arguing that *suppression* is not always detrimental (Mamat & Anderson, 2023).

3.2.3.5. Academic achievement. We estimated bivariate correlations of the ER scores, modeled as latent variables, with students' current academic grade-point average (GPA) as a manifest variable (Table 3). *Reappraisal* and *competence development* for regulating enjoyment and anxiety, but not boredom, correlated positively with GPA. Coefficients for these linkages indicate moderate to strong relations. These relations may be due to positive feedback loops: Reappraisal and competence development can help to promote effective learning, sustained effort, and achievement; in turn, success at learning may facilitate the use of these strategies. *Situation selection*, in contrast, was associated with lower achievement. No substantial relations were found for the remaining strategies, aligning with the previous observation that their functions in academic settings may be more ambivalent.

3.2.3.6. Gender. We examined correlations of the ER scales, modeled as latent variables, with students' gender as a manifest variable. Small to moderate gender differences emerged for *social support seeking*, *expression*, and *suppression* (Table 3). The results align with prior work on gender differences in ER and may reflect persisting influences of socio-cultural norms or stereotypes regarding emotional responding and

regulation (Gross, 2015; McRae et al., 2008). For enjoyment and anxiety, *social support seeking* and *expression* were more strongly endorsed by female students, whereas *suppression* of these emotions was reported more frequently by male students. For boredom, female students reported more frequent use of *social support seeking* than their male counterparts, but there were no differences for *expression* or *suppression*. Taken together, gender seems to explain only little variance in ER strategy use between individuals.

3.2.3.7. Domain-general emotion regulation. To probe the context specificity of students' ER, we examined relations between the RAEQ scales with the ERQ which provides domain-general measures of individuals' use of reappraisal and suppression. We computed three separate models for regulating achievement-related enjoyment, anxiety, and boredom at university. Each model contained the six regulatory strategies assessed in the RAEQ as well as the two ERQ subscales, all modeled as latent variables (see Table S4 for CFA of the ERQ). As expected, the *reappraisal* and *suppression* scales of the RAEQ were positively related with the corresponding domain-general ERQ scales (moderate to large effects; Table S5). Importantly, all $r \leq .57$, indicating sufficient distinctness and underscoring the relevance of context-specific assessment. The remaining RAEQ scales were also related to the ERQ in expected ways (e. g., positive relations between *competence development* and ERQ reappraisal, negative relations between *expression* and ERQ suppression, and negative relations between *social support seeking* and ERQ suppression). As such, the RAEQ scales are meaningfully related to domain-general ER, but assess distinct constructs.

3.3. Summary of Study 1 findings

Study 1 provides supporting evidence for the proposed structure of ER strategies targeting three important achievement emotions. Specifically, the findings attest to the importance of assessing ER strategy use in an emotion- as well as context-specific manner. The strategy scales were related to their target achievement emotions in expected ways; furthermore, they were related to students' perceived regulatory effectiveness, academic well-being, health problems, and overall academic achievement at university. Bearing in mind the cross-sectional study design, the findings point to potential maladaptive ER-correlate feedback loops for regulating emotions via *situation selection*, and more adaptive feedback loops for *reappraisal* and *competence development* strategies; for *social support seeking*, *suppression*, and *expression*, relations were less pronounced and varied across correlates. Main findings for relations between ER and emotions, well-being, and health across Studies 1–3 are summarized in Table 6 for comparative purposes.

4. Study 2

Study 2 examined the robustness of the findings obtained in Study 1 in a different academic context. As outlined in section 1.2.3.4, higher education in Germany and England differs in various aspects that shape different academic contexts for students. Using a sample of English university students, we expected to replicate the Study 1 findings on structures and correlates of students' ER.

Research on contextual influences on ER in education is lacking to date. CVT proposes that characteristics of academic environments should influence appraisals and thereby influence mean levels of emotions; to the extent that basic mechanisms of human psychological functioning are universal, however, links between different approaches to managing emotions with antecedents and outcomes should be similar across contexts (e.g., Pekrun & Goetz, 2024; Vansteenkiste, Ryan, & Soenens, 2020). As such, it is plausible to assume that relations between ER strategies and emotions, well-being, and health should be similar for German and English students. This study put this assumption to a first test. Replicating Study 1, the study used a cross-sectional design. As

such, we again focused on examining correlations, but conducted analyses on a latent level where applicable.

4.1. Method

4.1.1. Sample and procedure

Participants were 359 students ($M_{\text{age}} = 23.98$ years, $SD = 6.53$ based on $N = 334$; 204 [56.8%] female, 128 [35.7%] male, 6 [1.7%] non-binary, 1 [.3%] not reported, 20 [5.6%] missing) enrolled at a medium-sized university in England. Most students ($N = 234$; 65.5%) indicated that English was their native language. They were enrolled in various study programs including psychology ($N = 191$; 53.2%), business and economics ($N = 24$; 6.7%), natural sciences and mathematics ($N = 14$; 3.9%), and most were in their second to fourth year at university ($N = 231$; 68.1%; $N = 104$ [29.9%] first-year students). Students were recruited via a university mailing list. Ethics approval was obtained from the institution's ethics committee. Participation was voluntary, and students provided informed consent prior to the study. They received course credit for completing the web-based survey.

4.1.2. Measures

4.1.2.1. Emotion regulation strategies. Students' ER strategies for managing enjoyment, anxiety, and boredom at university were assessed using the RAEQ. The instrument was translated into English using a translation/back-translation procedure involving a bilingual German-English speaker and a native speaker of German, also fluent in English. Prior to data collection, we asked four advanced psychology undergraduate students to check the items for comprehensibility. Select items were adapted to fit the university context of the present sample. For example, item 2 of the *situation selection* scale for anxiety regulation refers to postponing an exam in the German versus selecting modules that do not include exams in the English version. Mean alpha for the 18 subscales was .81 (Table 1).

4.1.2.2. Achievement emotions. We used the English version of the AEQ-R (Pekrun et al., 2023) to assess enjoyment ($\alpha = .79$), anxiety ($\alpha = .93$), and boredom ($\alpha = .91$). Participants responded on a 5-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*).

4.1.2.3. Perceived regulatory effectiveness. Perceived regulatory effectiveness for managing enjoyment, anxiety, and boredom was measured with one item per emotion. Items were translated into English via translation/back-translation. Students indicated on a 10-point scale ranging from (1) *not at all* to (10) *very*, to what degree they perceived themselves able to influence their enjoyment, anxiety, or boredom, respectively, at university.

4.1.2.4. Academic well-being. We translated the SWBS used in Study 1 into English using the translation/back-translation procedure described above ($\alpha = .92$). Students rated their well-being at university on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*).

Due to technical issues during data collection, well-being data is available for 211 students.

4.1.2.5. Health problems. We measured health problems via the same scale ($\alpha = .86$) used in Study 1 based on the original English items of the PHQ-15 (Kroenke et al., 2002). Students reported on 10 symptoms on a scale ranging from 1 (*never*) to 5 (*daily*).

4.1.2.6. Perceived academic success. Students rated their academic success in their current academic year on a scale ranging from 1 (*very unsuccessful*) to 10 (*very successful*).

4.1.2.7. Domain-general emotion regulation. We assessed students'

general use of reappraisal (6 items; $\alpha = .89$) and suppression (4 items; $\alpha = .79$) to regulate emotions in their daily lives using the original English version of the ERQ (Gross & John, 2003). Items were assessed on a 7-point scale (1 = *not at all true* to 7 = *completely true*).

4.2. Results and discussion

4.2.1. Score distributions of RAEQ scales

As in Study 1, mean scores and variances suggest that undergraduate students use all 18 strategies assessed, but also imply substantial inter-individual differences, similar to their German counterparts (Table 1). Moreover, similar to Study 1, *reappraisal* and *competence development* constituted the most commonly reported strategies for all three emotions. Upregulation of enjoyment via *situation selection* was more commonly reported by students in this UK sample, potentially pointing to a contextual influence on ER that warrants further consideration. Taken together, these findings again corroborate that students' regulatory efforts can involve a range of different strategies, and that ER strategy use varies between individuals and across different emotions.

4.2.2. Structural validity

4.2.2.1. Confirmatory factor analysis. We used the same SEM procedures as in Study 1. As there were some missing data (2.34% in total across all 18 scales), we used full information maximum likelihood (FIML) estimation to obtain unbiased estimates (Enders, 2010). The CFA models fit the data well: For all scales, CFIs were $\geq .94$, TLIs $\geq .97$ (where applicable), RMSEAs $\leq .06$ (where applicable), and SRMRs $\leq .04$ (see Table S1 in supplementary materials). These findings support the assumed dimensionality of the strategy scales also for English students.

4.2.2.2. Correlations between RAEQ scales. As in Study 1, we computed disattenuated correlations among all 18 ER scales based on CFA factor scores (see Table S1 for factor score determinacy indexes, all $\geq .88$, and McDonald's ω ; see Table S2 for correlations). All 306 disattenuated correlations were $r \leq |.80|$, and 278 (90.8%) were $\leq |.50|$, again documenting discriminant validity of the scales. Aligning with Study 1, correlations between corresponding strategies across emotions were positive. In terms of relations between different strategies, *social support seeking* and *expression* as well as *reappraisal* and *competence development* were positively related for all three emotions, whereas *expression* and *suppression* of emotion were negatively related. These correlations again document sufficient separability of the strategies.

4.2.2.3. Exploratory structural equation modeling. We used the same ESEM analysis as in Study 1 to examine the structure of the ER scales in this sample and university context. With CFIs $\geq .96$, TLIs $\geq .93$, RMSEAs $\leq .05$, and SRMRs $\leq .03$ (Table S3), the emotion-specific models showed excellent fit and speak to the separability of the ER scales.

4.2.3. Correlates

For a summary of the main findings for ER-correlate relations in Study 2 as well as Studies 1 and 3, see Table 6.

4.2.3.1. Achievement emotions. Following Study 1, we estimated relations between the ER strategies and emotions using three separate latent correlation models for regulating enjoyment, anxiety, and boredom. Each model contained the six ER strategies and three emotions, all modeled as latent variables. Prior to these analyses, we verified the structures of the emotion scales in the present sample using CFA (Table S4).

As in Study 1, most regulatory strategies were significantly related to the *target* emotion, with coefficients ranging from small to large magnitude (Table 2). Again, *reappraisal* was consistently related to all three emotions; associations were positive for enjoyment, and negative

for anxiety and boredom, attesting to the robustness of these linkages across German and English students. Similarly, *situation selection* was substantially positively related to anxiety and boredom. In contrast to Study 1, however, it was also positively related to enjoyment. Surprisingly, *suppression* was not related to any of the three emotions. In contrast, *social support seeking* was associated with higher levels of all three emotions. Additionally, *competence development* strategies were positively related to enjoyment and negatively to boredom, as in Study 1, but were not related to anxiety.

As in Study 1, relations between ER strategies with *non-target* emotions also emerged. Overall, the findings from Study 2 corroborate that students' ER strategies are systematically associated with their achievement emotions.

4.2.3.2. Perceived regulatory effectiveness. As in Study 1, we estimated correlations of the ER scales, modeled as latent variables, with perceived regulatory effectiveness targeting enjoyment, anxiety, and boredom as manifest variables. Manifest correlations between the three emotion-specific regulatory effectiveness indicators were again positive and significant ($r_s = .46$ to $.57$) but speak to their separability.

Overall, the associations between ER strategies and perceived regulatory effectiveness were similar to those in Study 1 (Table 3). *Reappraisal* and *competence development* strategies were positively related to regulatory effectiveness for all three emotions. *Situation selection* was negatively related to effectiveness for anxiety and boredom, but not enjoyment (in contrast to Study 1). Except for the nonsignificant relation between *suppression* of enjoyment and anxiety with effectiveness, the remaining patterns paralleled those for the German sample. Taken together, the findings suggest that higher levels of perceived regulatory effectiveness are positively related to *reappraisal* and *competence development*. *Situation selection* is connected to lower levels of perceived effectiveness. For *expression* and *suppression*, findings were less consistent and differed for positive versus negative emotions, implying their functions may vary across emotions and samples.

4.2.3.3. Academic well-being. As in Study 1, we examined links between ER and well-being at university using three separate latent correlation models for regulating enjoyment, anxiety, and boredom, respectively (see Table S4 for CFA of the well-being scale). Overall, most relations align with the linkages that emerged in Study 1. Specifically, *reappraisal* and *competence development* strategies were positively linked with well-being for all three emotions (i.e., regulating enjoyment, anxiety, and boredom; Table 3). Noting that these relations likely reflect reciprocal influences of well-being and regulatory efforts, these findings suggest that these two strategies may be particularly beneficial for students' well-being at university in both German and English university contexts.

Furthermore, as in Study 1, regulating anxiety and boredom via *situation selection* was negatively linked with well-being; however, in contrast to Study 1, no significant relation emerged for enjoyment. For *social support seeking*, *expression*, and *suppression*, linkages varied across emotions in similar ways as in Study 1, with two exceptions. In Study 2, *suppression* of enjoyment and *social support seeking* for regulating boredom were not significantly related to well-being; in terms of directions of relations, they were consistent Study 1, however. Overall, the results attest to the importance of students' ER for their well-being (and vice versa) and reveal similar linkages in German and English students.

4.2.3.4. Health problems. Following Study 1, we estimated correlations between ER strategies and health problems in three separate latent correlation models for regulating enjoyment, anxiety, and boredom, respectively (see Table S4 for CFA of health problems scale). Some of the correlations differed from the patterns observed in Study 1 (Table 3). Most notably, *reappraisal* and *competence development* were not significantly linked with students' health problems. In contrast, for anxiety and boredom, *social support seeking* was positively related to health

problems. The latter might indicate that students who experience health problems more frequently were more prone to seek consolation or support to regulate these emotions. As this pattern did not emerge in Study 1, one implication may be to consider the accessibility and nature of support systems implemented in different universities and academic cultures. However, several relations aligned with our Study 1 findings. For instance, we again found that using *situation selection* and *expression* to regulate anxiety and boredom was positively related to health problems, revealing cross-country parallels.

4.2.3.5. Perceived academic success. We estimated correlations of the RAEQ scales, modeled as latent variables, with perceived academic success as a manifest variable in separate models. For *reappraisal* and *competence development*, relations with perceived success were similar to those found for students' GPA in Study 1 in terms of both direction and magnitude (Table 3). Using *situation selection* to regulate anxiety and boredom was, in contrast, again negatively related with perceived academic success. In contrast to Study 1, this was not the case for regulating enjoyment. *Social support seeking* and *expressing* enjoyment was positively, and *suppressing* enjoyment negatively associated with perceived success; *expression* and *suppression* of anxiety and boredom showed no systematic relations with this variable, similar to Study 1. Overall, linkages with correlates, including perceived academic success, are most consistent for *situation selection*, *reappraisal*, and *competence development*.

4.2.3.6. Gender. We computed correlations of the RAEQ scales, modeled as latent variables, with students' gender as a manifest variable. In contrast to Study 1, there were no significant relations between ER and gender (Table 3). These findings may point to different display rules for emotions experienced in university settings by students in our samples, but more research is needed to explain these differences. Overall, the present study underscores our Study 1 findings in that gender explained little variance in ER strategy use.

4.2.3.7. Domain-general emotion regulation. Finally, we examined relations between the RAEQ and domain-general ERQ scales estimated in three separate models for regulating enjoyment, anxiety, and boredom. Each model contained the six regulatory strategies assessed in the RAEQ as well as the ERQ subscales, all modeled as latent variables (see Table S4 for CFA of the ERQ). As in Study 1, the *reappraisal* and *suppression* subscales of the RAEQ were positively related with the corresponding ERQ scales (Table S5). However, all latent correlations were $r \leq |.49|$, attesting to the separability of the constructs also in the English student sample.

5. Study 3

In Study 3, we again tested the structures and interrelations among students' habitual use of ER strategies for managing enjoyment, anxiety, and boredom, and examined their relations with achievement emotions, academic well-being, and health problems. We employed a prospective design involving five assessments over one semester at university, based on a sample of German university students. This allowed for examining relations between constructs over time, and considering emotions, well-being, and health both as potential predictors as well as outcomes of achievement emotion regulation.

We expected to replicate the findings of Studies 1 and 2 regarding the structure and relations among students' ER strategies. Furthermore, we expected substantial predictive relations between students' emotions and subsequent use of ER strategies, as well as between students' ER and subsequent achievement emotions. We also expected feedback loops among students' ER and their well-being as well as experienced health problems over time. Considering the patterns of relations in Studies 1 and 2, we anticipated these relations to be most pronounced for *situation selection*, *reappraisal*, and *competence development*.

Furthermore, we explored relations between students' ER and their end-of-semester test scores to probe whether ER strategies are also linked to more distal educational outcomes. Our analyses were grounded in the assumption that ER impacts emotions, which, in turn, influence learning and achievement (Harley, Pekrun, et al., 2019; Pekrun & Stephens, 2009).

5.1. Method

5.1.1. Sample and procedure

The sample consisted of 198 undergraduate students ($M_{\text{age}} = 21.03$ years, $SD = 3.76$; 152 [76.8%] female, 45 [22.7%] male, 1 [5%] missing) attending a mid-sized German university and enrolled in a mandatory introductory psychology course for students in different pre-service teaching programs (i.e., programs focused on teaching at elementary or secondary school) and studying different subjects (e.g., mathematics, sciences, language arts, foreign languages, history, geography, arts, physical education). The course was offered digitally due to the Covid-19-related lockdown in the winter 2020/2021 and involved weekly online meetings with content presentation, interactive tasks and discussions, and weekly worksheets graded on a pass/fail basis. Most students ($N = 187$; 94.9%) indicated that German was their native language and that they were in their first semester at university ($N = 173$; 87.4%; range = 1 to 9 semesters). The study was conducted per the German Psychological Association's and the American Psychological Association's ethical principles and the institutional requirements at the university. Participation was voluntary. Students provided informed consent prior to the study.

The study comprised five assessments (T1–T5) over the winter semester 2020/2021.

T1 ($N = 197$) was conducted in Week 3 of the semester and served to inform participants about the study as well as to collect demographic data. In Week 6 (T2; $N = 198$), students reported on their achievement emotions, health problems, and academic well-being. In Week 12 (T3; $N = 198$), we assessed their use of ER strategies targeting enjoyment, anxiety, and boredom. In week 14 (T4; $N = 196$), students again reported on their emotions, health problems, and well-being, and we requested permission to access their test scores on the final course exam which took place in week 16 (T5; $N = 168$). The overall length of the study was 4 months. T1–T4 assessments were conducted online.

5.1.2. Measures

5.1.2.1. Emotion regulation strategies. As in Studies 1 and 2, students' ER strategies for managing achievement-related enjoyment, anxiety, and were assessed using the RAEQ. In the present study, we instructed students to focus on their strategies for managing emotions experienced within the course. Alphas for the 18 subscales were all $\geq .72$ (see Table 1).

5.1.2.2. Achievement emotions. Students' enjoyment, anxiety, and boredom were assessed at T2 and T4 using the AEQ-R (Pekrun et al., 2023). Participants reported on their emotions experienced in the course on a five-point scale (1 = *strongly disagree*; 5 = *strongly agree*). Alphas ranged from .79 to .93 across emotions and timepoints (Table S4).

5.1.2.3. Academic well-being. Students' well-being was assessed using an adapted version of the school-related well-being scale (Stockinger et al., 2023; see Study 1) at T2 and T4 ($\alpha = .85$ and $.87$, respectively).

5.1.2.4. Health problems. Students' experience of physical health problems in daily life (see Study 1) was assessed at T2 and T4 ($\alpha = .80$ and $.81$, respectively).

5.1.2.5. Test scores. Students completed a 20-item multiple-choice test

on the course content. The questions were pretested and varied in difficulty levels and educational objectives (e.g., recalling, understanding, and applying information; $\alpha = .72$, Table S4). We obtained test scores for 168 students.

5.2. Results and discussion

5.2.1. Score distributions of RAEQ scales

In line with Studies 1 and 2, mean scores and variances show that students used all strategies within the context of the university course they were attending, but also point to interindividual differences in strategy use (Table 1). The findings again suggest that *reappraisal* and *competence development* are among the most commonly used strategies. In contrast to Study 2, but similar to Study 1 which also involved German students, *situation selection* was less commonly used for regulating enjoyment.

5.2.2. Structural validity

5.2.2.1. Confirmatory factor analysis. We used the same SEM procedures as in Studies 1 and 2. There were no missing data for the ER scales. The CFA models fit the data well: For all scales, CFIs were $\geq .96$, TLIs $\geq .94$ (where applicable), RMSEAs $\leq .07$ (where applicable), and SRMRs $\leq .04$ (see Table S1). These findings indicate that the assumed dimensionality of the scales also holds when assessing ER in a course-specific manner.

5.2.2.2. Correlations between RAEQ scales. As in Studies 1 and 2, we computed disattenuated correlations among all 18 ER scales based on CFA factor scores (see Table S1 for factor score determinacy indexes, all $\geq .82$, and McDonald's ω ; see Table S2 for correlations). All 306 disattenuated correlations were $\leq |.77|$ with one exception; the disattenuated correlation among the *social support seeking* scales for anxiety and boredom was .897. Most correlations (284; 92.8%) were $\leq |.50|$. Again, correlations between corresponding strategies across emotions were positive. In terms of emotion-specific relations between different strategies, *social support seeking* and *expression* as well as *reappraisal* and *competence development* were consistently positively related, whereas *expression* and *suppression* of emotion were negatively related. Overall, the findings again suggest that the scales measure separable strategies in an emotion-specific manner.

5.2.2.3. Exploratory structural equation modeling. We used the same ESEM procedure as in Studies 1 and 2 to examine the factorial structure of the ER scales. With CFIs $\geq .94$, TLIs $\geq .90$, RMSEAs $\leq .05$, and SRMRs $\leq .03$ (see Table S3), the emotion-specific models fit the data reasonably well and further document the separability of the ER strategies.

5.2.3. Correlates

For a summary of the main findings for ER-correlate relations in Study 3 as well as Studies 1 and 2, see Table 6.

5.2.3.1. Latent correlations with achievement emotions. We examined bivariate links between students' ER strategies at T3 and their course-related emotions at T2 and T4 based on latent correlation models. Each model included the six ER strategies for regulating either enjoyment, anxiety, or boredom, and one emotion variable, all modeled as latent constructs.

Several noteworthy associations between T2 emotions and T3 ER strategies appeared (Table S7). As in Studies 1 and 2, patterns were most consistent and effect sizes most pronounced for *situation selection* (moderate to large effects), *reappraisal* (small to large effects), and *competence development* (large effects). T2 enjoyment was negatively related to subsequent *situation selection*, and positively to *reappraisal* as well as *competence development*. Higher levels of enjoyment may thus

lead to more frequent reliance on *reappraisal* and *competence development* to maintain or upregulate the experience of this emotion over time; moreover, positive activating emotions like enjoyment may equip students with energetic resources and cognitive flexibility that are needed to engage in these regulatory strategies effectively (see 1.2.3.1). For anxiety and boredom, the opposite pattern emerged (although the relation between anxiety and *competence development* did not reach significance); students with higher levels of anxiety or boredom may be driven towards habitual reliance on *situation selection* instead. As higher levels of negative emotions can be energetically draining and reduce flexibility, habitual experience of anxiety and boredom may make it more difficult to (effectively) implement cognitive reappraisal or engage in competence development strategies. For *suppression*, in contrast, no relations with T2 emotions occurred for any of the three emotions. For *social support seeking* and *expression*, relations were more variable. Only anxiety was related to *social support seeking* (positive, small-to-moderate relation), whereas enjoyment and boredom were positively related to *expression* of these emotions (moderate and large effects, respectively).

As in Studies 1 and 2, we also found relations between ER strategies and non-target emotions at T2, suggesting that the experience of a given achievement emotion may also influence regulatory behaviors targeting other emotions. This may be particularly the case for regulatory efforts targeting enjoyment and boredom, and the experience of these achievement emotions. For example, boredom experienced at T2 was negatively related to regulating enjoyment via *reappraisal* and *competence development*. Conversely, T2 enjoyment was negatively related to regulating boredom via *reappraisal* and *competence development*. The regulation of these emotions may thus be systematically connected, but as per the magnitude of the coefficients, reappraisal and competence development constitute separable processes.

Regarding relations between ER strategies and T4 target emotions, our findings point to reciprocal processes over time, with most consistent and pronounced patterns for *reappraisal*, *competence development*, and *expression* to manage enjoyment and boredom, respectively (moderate to large effects). For enjoyment, these relations were all positive, suggesting that more frequent use of these strategies can boost students' experience of this emotion over time. *Reappraisal* and *competence development* to manage boredom, in contrast, were associated with lower subsequent levels of this emotion; *expression* of boredom was associated with higher levels of this emotion at T4. Curiously, T4 anxiety was not significantly related to these strategies. It was, however, positively related to *social support seeking* (small-to-moderate effect size), implying that students with higher levels of anxiety not only engage in more *social support seeking* (see relations for T2 anxiety), but also that reliance on this strategy can boost subsequent anxiety. As such, Study 3 again highlights the importance of examining university students' support systems and effective provision of emotional support in more detail. Furthermore, use of *situation selection* was positively associated with anxiety and boredom, but not related to enjoyment, at T4, pointing to maladaptive emotional outcomes of this strategy. *Suppression*, in contrast, was virtually unrelated to subsequent experiences of emotions. This reflects that in achievement settings, too, suppression constitutes a strategy that can provide momentary, short-term emotional relief but is likely inefficient for sustainably managing emotions over time, particularly for resolving negative achievement emotions.

Again, relations between regulatory strategy use and non-target emotions were most pronounced for enjoyment and boredom. Interestingly, while regulating anxiety via *competence development* was unrelated to anxiety, it was strongly related to higher levels of enjoyment and lower levels of boredom. Taken together, the findings provide correlational evidence for linkages between emotions and subsequent use of regulation strategies, and vice versa, over time, in line with the assumption that emotions are both drivers and outcomes of students' regulatory efforts.

Table 4

Emotion regulation strategies as predictors of subsequent emotions: Latent multiple regression analyses (Studies 3, Time 3–4).

Predictor	Enjoyment at T4				Anxiety at T4				Boredom at T4			
	ER → EMO		Gender → ER		ER → EMO		Gender → ER		ER → EMO		Gender → ER	
	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
<i>Regulating Enjoyment</i>												
Situation selection	−.07	.10	−.06	.08	.22	.08	−.06	.08	.50	.08	−.06	.08
Social support seeking	−.23	.09	.19	.08	.12	.09	.19	.08	.04	.08	.19	.08
Reappraisal	.32	.13	.16	.09	−.21	.10	.15	.09	−.09	.13	.16	.09
Expression	.40	.08	.16	.08	−.02	.08	.16	.08	.07	.09	.16	.08
Suppression	.18	.09	−.25	.07	.03	.09	−.25	.09	−.11	.08	−.25	.09
Competence development	.16	.12	.10	.06	.20	.10	.10	.07	−.30	.11	.10	.07
Gender → EMO	−.01	.07			.18	.07			−.08	.08		
R^2_{EMO}	.37	.08			.18	.08			.38	.08		
<i>Regulating Anxiety</i>												
Situation selection	.01	.10	−.01	.08	.24	.09	−.01	.08	.28	.09	−.01	.08
Social support seeking	.08	.14	.30	.08	.30	.11	.30	.08	.10	.12	.30	.08
Reappraisal	.05	.14	.19	.07	−.24	.09	.19	.07	.01	.11	.19	.07
Expression	−.12	.11	.23	.08	−.06	.12	.23	.08	.14	.12	.23	.08
Suppression	.05	.10	−.08	.10	−.03	.09	−.08	.09	.08	.10	−.08	.09
Competence development	.39	.13	.23	.08	−.11	.10	.22	.09	−.43	.12	.21	.09
Gender → EMO	−.05	.08			.11	.07			−.09	.09		
R^2_{EMO}	.17	.09			.24	.10			.31	.09		
<i>Regulating Boredom</i>												
Situation selection	−.04	.11	−.02	.08	.08	.11	−.02	.08	.10	.12	−.02	.08
Social support seeking	−.05	.15	.27	.08	.27	.09	.26	.08	.05	.10	.27	.08
Reappraisal	.34	.16	.16	.07	−.05	.10	.16	.07	−.09	.11	.16	.07
Expression	.03	.12	.06	.11	.20	.12	.06	.11	.42	.11	.03	.11
Suppression	−.02	.10	.01	.08	.23	.09	.01	.08	.17	.08	.01	.08
Competence development	.32	.14	.17	.08	−.09	.15	.17	.08	−.49	.14	.17	.08
Gender → EMO	−.06	.08			.12	.07			−.06	.08		
R^2_{EMO}	.22	.10			.21	.06			.47	.13		

Note. Reported are standardized path coefficients, standard errors, and residual variances for achievement emotions as outcomes of emotion regulation strategy use at T3 and gender. Gender is coded 1 = male, 2 = female. EMO = respective achievement emotion at T4. ER = emotion regulation strategy at T3. **Bold** path coefficients: $p < .05$.

5.2.3.2. Latent multiple regression models for ER and achievement emotions. We used latent multiple regression analysis to examine the joint power of the six ER strategies assessed at T3 to predict students' subsequent levels of achievement emotions at T4. Due to the high stability of emotions across T2 and T4 (Table S6), autoregressive effects of emotions were not included, as no sufficient variance would have been left to be explained by the predictors (see Pekrun et al., 2023, for a similar approach). We conducted separate sets of analyses for strategies for managing enjoyment, anxiety, and boredom as predictors of either enjoyment, anxiety, or boredom as the dependent variable, controlling for effects of gender on regulatory strategies and achievement emotions (Table 4).

We found that enjoyment was positively predicted by *expression* (strongest predictor; large effect) and *reappraisal* (moderate-to-large effect), similar to the latent correlations, and negatively by *social support seeking* (small-to-moderate effect). *Competence development* did not emerge as a significant predictor of subsequent enjoyment when examining joint relations between all regulatory strategies with this emotion. In terms of relations with non-target emotions, *situation selection* to manage enjoyment positively predicted students' subsequent anxiety (small-to-moderate effect) and boredom (large effect), pointing to maladaptive effects of this strategy. Furthermore, *reappraisal* for managing enjoyment negatively predicted anxiety, and *competence development* negatively predicted and boredom. Surprisingly, *competence development* for regulating enjoyment positively predicted anxiety in the multiple regression model; one explanation for this may be that striving for academic success can boost the negative value of failure, thereby increasing anxiety.

For strategies targeting anxiety, we found that *reappraisal* negatively predicted subsequent anxiety, whereas both *situation selection* and *social support seeking* (strongest predictor) positively predicted anxiety, with all three effects reaching small-to-moderate magnitudes. Using situation

selection to manage anxiety also positively predicted subsequent boredom (moderate effect). In contrast, *competence development* to manage anxiety positively predicted enjoyment and negatively predicted boredom (large effects). As such, developing competencies to regulate anxiety can influence enjoyment and boredom in adaptive ways; the negative relation with anxiety was nonsignificant (see Burić et al., 2016, for similar results).

For strategies targeting boredom, we found that boredom was negatively predicted by prior use of *competence development* (strongest predictor; large effect), but positively by both *expression* (large effect) and *suppression* (small-to-moderate effect), implying that these two strategies can contribute to amplifying boredom. Interestingly, *expressing* and *suppressing* boredom also positively predicted subsequent anxiety (small-to-moderate effects). In contrast to the latent correlation results, managing boredom via *reappraisal* did not significantly predict subsequent boredom; it did, however, positively predict subsequent enjoyment (moderate-to-large effect), as did the use of *competence development*. Interestingly, managing boredom via *social support seeking* also positively predicted anxiety (moderate effect).

In terms of predictive effects of gender, the findings largely correspond to the Study 1 correlational results. *Social support seeking* was higher for female students for all three emotions (i.e., regulating enjoyment, anxiety, and boredom). *Expression* of enjoyment and anxiety was also more frequently reported by female students; *suppression* of enjoyment, in contrast, was more frequent among male students. Interestingly, use of *reappraisal* and *competence development* strategies to manage anxiety and boredom was also more frequent among female students. The findings thus again point to systematic gender differences in strategy use in German university settings, and that these differences also vary across different emotions, highlighting the importance of controlling for gender in our analyses.

Taken together, ER strategies differentially impact emotions;

different strategies emerged as the strongest predictors of achievement emotions. Moreover, strategies that have received comparatively little empirical attention to date, especially in educational settings (i.e., *situation selection*; *expression*; *competence development*), were strong predictors of emotions, especially enjoyment and anxiety. In contrast, *suppression*, a relatively well-studied strategy, explained little variance in achievement emotions.

5.2.3.3. Latent correlations with academic well-being. We used latent correlation models to examine relations between ER strategies at T3 and academic well-being at T2 and T4. Each model included the six ER strategies for regulating either enjoyment, anxiety, or boredom, and subjective well-being, all modeled as latent constructs (Table S7).

T2 well-being was consistently negatively related to T3 use of *situation selection*, but positively to use of *reappraisal* and *competence development* strategies. Conversely, T3 *situation selection* was negatively, and *reappraisal* as well as *competence development* positively related to subsequent well-being at T4. These patterns point to positive feedback loops between well-being and reappraisal as well as competence development strategies: Higher levels of well-being may promote the use of these strategies, and the use of these strategies, in turn, can boost student well-being over time. In contrast, lower levels of well-being may drive students to more readily use situation selection, and engaging in this strategy coincides with lower subsequent well-being. The effect sizes reflect moderate to large relations between course-specific emotions and academic well-being over time.

For the remaining strategies, findings were more mixed and less pronounced. For example, T2 well-being was not significantly related to subsequent use of *social support seeking*, whereas engaging in *social support seeking* at T3 was related to higher levels of well-being at T4. *Expression* of anxiety and boredom was unrelated to student well-being; relations were also nonsignificant for the *expression* of enjoyment but

point to small (positive) effects. *Suppression* of anxiety, but not enjoyment or boredom, was positively related to subsequent well-being (moderate effect size).

Taken together, the findings suggest that ER and student well-being are related over time, and that these relations may be driven by *situation selection*, *reappraisal*, and *competence development* strategies (cf. Beaumont et al., 2023 on positive links between reappraisal and well-being vs. lack of linkages for suppression in secondary school students).

5.2.3.4. Latent multiple regression models for ER and well-being. We examined the joint power of the six ER strategies assessed at T3 to predict students' subsequent levels of academic well-being at T4. Due to the high stability of well-being across T2 and T4 (Table S6), autoregressive effects of this variable were not included. We ran three sets of analyses for ER strategy use for managing enjoyment, anxiety, and boredom as predictors of well-being as the dependent variable, controlling for gender (Table 5).

Use of *situation selection* negatively predicted subsequent well-being (moderate to large effects) in all three analyses. Furthermore, use of *competence development* to manage enjoyment and boredom positively predicted well-being (moderate to large effects); for regulating boredom, this relation was not significant. As such, knowledge and skill development strategies may be particularly beneficial for promoting academic well-being. Use of *reappraisal* to regulate boredom also positively predicted students' subsequent well-being (small-to-moderate effect); for enjoyment, this relation was nonsignificant. Curiously, we also found that *suppression* of enjoyment was associated with slightly higher subsequent well-being. Although this effect was small, it warrants follow-up inspection in future studies considering potential side effects of regulatory strategies. Taken together, students' regulatory efforts also translate to differences in levels of well-being over time.

Table 5

Emotion regulation strategies as predictors of academic well-being and health problems: Latent multiple regression analyses (Study 3, time 3–4).

Predictor	Academic Well-Being at T4				Health Problems at T4			
	ER → WB		Gender → ER		ER → HEALTH		Gender → ER	
	β	SE	β	SE	β	SE	β	SE
<i>Regulating Enjoyment</i>								
Situation selection	-.34	.08	-.06	.08	.02	.10	-.06	.08
Social support seeking	.15	.09	.19	.08	-.02	.10	.19	.08
Reappraisal	.21	.12	.13	.11	-.17	.10	.16	.08
Expression	.09	.10	.16	.08	.15	.10	.16	.09
Suppression	.16	.08	-.24	.09	.14	.10	-.25	.08
Competence development	.24	.11	.10	.07	-.03	.11	.09	.09
Gender → OUTCOME	.03	.07			.39	.08	.10	.07
R^2_{EMO}	.28	.07			.19	.07		
<i>Regulating Anxiety</i>								
Situation selection	-.25	.10	-.01	.08	.40	.09	-.01	.08
Social support seeking	.12	.11	.30	.08	-.03	.11	.30	.08
Reappraisal	.08	.11	.19	.07	-.10	.09	.19	.07
Expression	-.11	.11	.23	.08	.17	.11	.23	.08
Suppression	.17	.10	-.08	.09	.00	.09	-.08	.09
Competence development	.35	.14	.23	.09	.05	.10	.22	.09
Gender → OUTCOME	.01	.08			.33	.09		
R^2_{EMO}	.25	.08			.32	.09		
<i>Regulating Boredom</i>								
Situation selection	-.25	.11	-.02	.08	.40	.10	-.02	.08
Social support seeking	-.04	.10	.27	.08	.07	.11	.27	.07
Reappraisal	.23	.11	.16	.07	-.01	.12	.16	.07
Expression	.13	.12	.07	.11	.08	.13	.06	.11
Suppression	-.07	.09	.01	.08	.15	.09	.01	.07
Competence development	.24	.14	.17	.08	.06	.16	.16	.08
Gender → OUTCOME	.02	.07			.33	.08		
R^2_{EMO}	.20	.08			.32	.09		

Note. Reported are standardized path coefficients, standard errors, and residual variances for achievement emotions as outcomes of emotion regulation strategy use at T3 and gender. Gender is coded 1 = male, 2 = female. WB = well-being at T4. ER = emotion regulation strategy at T3. HEALTH = health problems at T4. **Bold** path coefficients: $p < .05$.

Table 6
Summary of key findings: Relations between ER strategies and achievement emotions, well-being, and health problems in Studies 1–3.

Strategy	Enjoyment				Anxiety				Boredom				Academic Well-Being				Health Problems			
	1	2	3-T2	3-T4	1	2	3-T2	3-T4	1	2	3-T2	3-T4	1	2	3-T2	3-T4	1	2	3-T2	3-T4
Regulating Enjoyment																				
Situation selection		+	--		++		++	++	+++		+++	+++		--			+			
Social support seeking	+	+++					++		++			+++		++		+				
Reappraisal	+++	+++	+++	+++	--					--	--	--		+++	++	+++	--			
Expression	++	+++	++	+++									+++	+++		+			+	
Suppression	-				+				++	++	+		--	++	+++					
Competence development	+++	+++	+++	+++					-		--	--		++	+++	+++				
Regulating Anxiety																				
Situation selection	--	--			+++		++	++	+++	+++	+++	+++		--	--	--	+	+++	+++	+++
Social support seeking		+			+	++	++	+	+	+	+			++	++	+	--	++		
Reappraisal	++	+++			--	--	-		-		-	-	++	+++		++	+			+
Expression	+	+			++	++	+								+	++	-	+		
Suppression	+															++	+			
Competence development	+++	+++			--				--	--	--	--	++	++	+++	+++	--			
Regulating Boredom																				
Situation selection	--	--			+++		++	+	+++	+++	+++	+++		--	--	--	+	+	+++	+++
Social support seeking		+					++	++	++	+	+		+	--			+	+	+	+
Reappraisal	+++	+++			-				-	-	-	-	++	++	+	+++	-	+		
Expression	+				+		++	++	++	++	++	++				++	+	++		+
Suppression	+	++							-	--	-	--	+				+	++		
Competence development	+++	+++					-	-	--	--	--	--	++	++	+++	+++	--	++	++	++

Note. + / – , + + / – – , + + + / – – – denote small, moderate, and large positive or negative bivariate latent correlations ($\rho \geq .15$, $+.25$, and $+.35$), respectively; Gignac & Szodorai, 2016 in Studies 1, 2, and 3. Studies 1 and 2 were cross-sectional. In Study 3, ER strategies were measured at T3, and correlates at T2 (see 3-T2) and T4 (see 3-T4).

5.2.3.5. *Latent correlations with health problems.* Using latent correlation models, we analyzed links between ER strategies for regulating enjoyment, anxiety, and boredom at T3 and health at T2 and T4. Each model included six ER strategies for regulating enjoyment, anxiety, or boredom, and health problems, all modeled as latent constructs (Table S7).

Overall, relations between students' ER and health problems were relatively weak and, for the most part, nonsignificant. Herein, it is important to consider that these correlations depict associations between course-specific emotions and general health problems. As such, it is noteworthy that we found reasonably strong relations of *situation selection* to manage anxiety and boredom to health problems. T2 health problems were positively related to *situation selection* at T3, and this strategy, in turn, was positively related to subsequent health problems at T4, pointing to maladaptive feedback loops over time. Moreover, *expression* of anxiety and boredom at T3 was positively related to health problems at T4 (small to moderate effects), suggesting that expression of these emotions may not only boost negative emotional experience, but also contribute to the experience of health problems.

5.2.3.6. *Latent multiple regression models for ER and health.* We examined the joint power of the six ER strategies assessed at T3 to predict students' subsequent levels of health problems at T4. Due to the high stability of health problems across T2 and T4 (Table S6), we did not include autoregressive effects of this variable. We ran separate analyses for ER strategies targeting enjoyment, anxiety, and boredom as predictors of well-being, controlling for effects of gender on the predictors and outcome variable (Table 5).

In line with the correlational analyses, only relations between *situation selection* to manage anxiety and boredom was significantly related to students' subsequent experience of health problems. In both cases, however, the effects were positive and rather strong, suggesting serious negative consequences of habitual reliance on this strategy.

5.2.3.7. *Latent correlations with test scores.* We explored relations between students' ER strategies at T3 and their end-of-semester test scores (T5). Latent correlations were computed separately for students' regulation of enjoyment, anxiety, and boredom, modeled as latent variables, and test scores (manifest variable). Findings revealed several significant relations, ranging from small to moderate magnitude (Table S8). Regulating enjoyment, anxiety, and boredom via *competence development* was positively related to students' test performance. *Seeking social support* to manage anxiety and using *reappraisal* to manage boredom were positively associated with test scores. In contrast, *situation selection* targeting anxiety was negatively related to achievement. These patterns suggest that regulatory efforts may translate to differences in subsequent test performance.

5.2.3.8. *Latent multiple regression models for ER and test scores.* To further probe linkages between ER and test performance, we regressed test scores separately onto their use of each strategy, while controlling for both gender as well as high-school GPA. When accounting for differences in prior achievement (Table S8), two strategies remained as significant predictors: managing anxiety via *situation selection* and managing boredom via *reappraisal*. As such, students' ER can also matter for distal performance outcomes.

6. General discussion

The present research examined university students' habitual use of strategies for regulating achievement emotions across three studies and two different countries. We analyzed individual differences in using six different strategies for managing commonly reported and impactful achievement emotions: enjoyment, anxiety, and boredom. As such, our studies are among the first to consider students' use of a broader set of

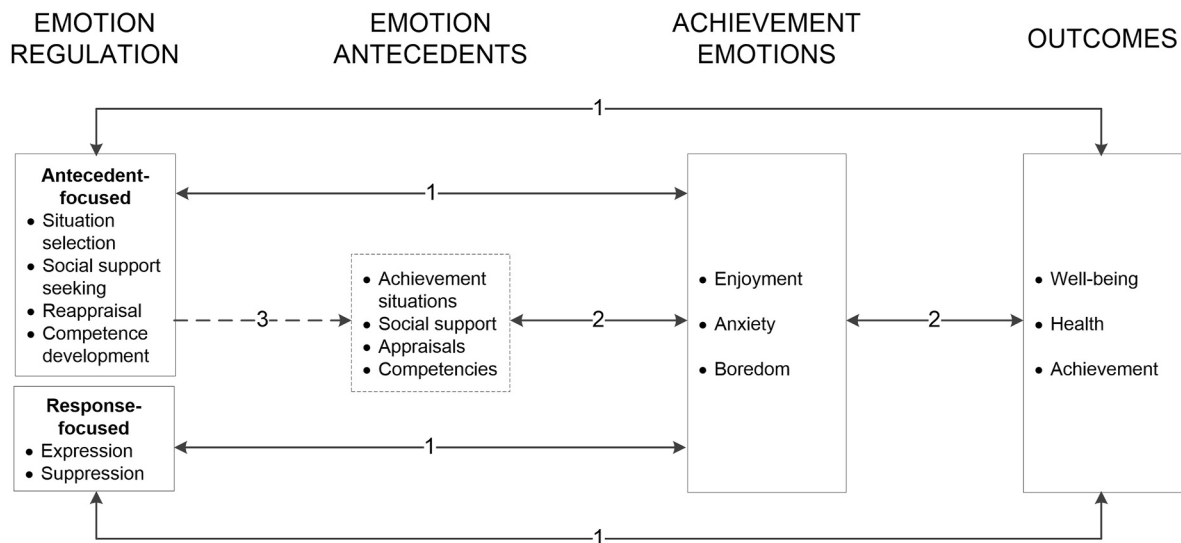


Fig. 2. Overview of Linkages between Achievement Emotion Regulation and Correlates Supported by the Present Research

Note. This figure outlines which of the proposed linkages between achievement emotion regulation strategies and correlates (1) were investigated in present research, (2) were established in prior research, and (3) need to be examined in future research. Double-headed arrows indicate bidirectional linkages.

strategies beyond reappraisal and suppression for managing not only negative but also positive emotions, and to explore the utility of emotion-specific measures of ER in academic settings. Herein, we built on prior work indicating that the use and functions of ER strategies can vary across individuals, contexts, and emotions (Aldao, 2013; Gross & Ford, 2024).

Guided by CVT and process models of ER (Gross, 2015; Harley, Pekrun, et al., 2019), we investigated *situation selection*, *social support seeking*, *reappraisal*, *expression*, *suppression*, and *competence development* strategies for managing achievement emotions in two cross-sectional and one prospective study. The findings provide evidence for the convergent and discriminant validity of the emotion-specific regulation scales of the RAEQ assessing these strategies. As summarized in Fig. 2, we also document meaningful relations with correlates of ER proposed in the literature, including emotions, well-being, physical health, and achievement-related outcomes. We also explored gender differences in, and potential influences of academic context on ER by sampling German and English university students.

Taken together, the findings attest to the relevance of the six proposed ER strategies for students' academic lives, particularly their well-being. Below, we discuss our findings on the internal structures of the domain of students' ER strategies and on their relations with correlate variables, and highlight directions for future research.

6.1. Internal structure of the domain of achievement emotion regulation strategies

In all three studies, students endorsed the 18 ER strategies (i.e., six strategies for regulating enjoyment, anxiety, and boredom, respectively), indicating that the scales capture relevant approaches for managing achievement emotions in university settings across different samples and educational contexts. In addition, we observed interindividual variation in the use of different strategies, as expected based on prior research on individual differences in ER (Griffin & Howard, 2022; McRae, 2013). Score distributions were similar across German and English university students except for *situation selection* strategies. Our findings suggest that these strategies may be more frequently used by English students. This points to potential influences of academic contexts on students' reliance on this strategy, and on socially accepted tactics for enacting it, underscoring the importance of considering context and characteristics of learning environments in students' ER in

future research. Furthermore, all three studies attest to the structural validity of the proposed scales.

The data attest to the dimensional homogeneity and discriminant validity of the scales and underlying constructs; substantively speaking, they show that the six ER strategies represent differentiable approaches for dealing with achievement emotions. In terms of relations between different strategies, we found that *expression* was positively related to *social support seeking* and negatively related to *suppression* across all three studies, indicating that students generally differ in their reliance on strategies involving outward displays of or communication about emotions versus inhibiting expressive behaviors. Furthermore, *reappraisal* and *competence development* were positively related in all three studies (see Burić et al., 2016, for similar results). This connection could be in part attributable to similar demands imposed by these strategies: Changing perceptions of control and value, and investing in study skills and comprehension to boost success, both require intense and persistent cognitive effort and motivational sustenance (Ford & Troy, 2019). As such, some students may be more readily able to use these strategies than their peers. Additionally, both strategies showed similar relations with external variables, pointing to functional similarities.

In addition, in all three studies, corresponding strategy scales targeting the regulation of either enjoyment, anxiety, or boredom were positively related, but also distinguishable. As such, the RAEQ can be used to trace emotion-specific ER habits in university students.

6.2. Relations with antecedent and outcomes

The findings show that students' habitual use of ER strategies explain substantial portions of variation in their habitual experiences of achievement emotions, their academic well-being, perceived physical health, and indicators of academic success (see Table 6 for a summary of main findings across Studies 1–3; see also Fig. 2 for a visual summary). They also corroborate the assumption that emotion-specific assessment if regulatory strategy use is helpful for understanding linkages between specific strategies and different correlates. For instance, relations between students' perceived regulatory effectiveness and use of *expression* and *suppression* varied substantially across the respective emotion-specific strategy scales. In addition, our findings for relations between students' domain-specific (i.e., achievement-focused) versus general ER strategy use attest to the need for contextualized perspectives. Our findings suggest that it matters how students regulate their achievement

emotions, particularly from a well-being perspective.

Bivariate linkages with correlates were most pronounced and consistent across studies for *situation selection*, *reappraisal*, and *competence development*. The cross-sectional and prospective data point to maladaptive associations for *situation selection*, and to adaptive relations for *reappraisal* and *competence development*. Specifically, we found that managing emotions by selecting appealing and avoiding unappealing achievement situations (e.g., via procrastination or skipping class, or signing up for courses that align with personal interests) is associated with higher anxiety, boredom, and health problems, and lower perceived regulatory effectiveness, academic well-being, and academic success. The positive associations between situation selection and negative achievement emotions imply that students experiencing more anxiety or boredom, on average, rely on this strategy more frequently and, conversely, that situation selection may increase subsequent levels of these emotions. Study 3 provides evidence for these maladaptive feedback loops over time: Prior levels of anxiety, boredom, and health problems positively predicted subsequent use of *situation selection* strategies, which, in turn, positively predicted subsequent experiences of these emotions and health problems. For academic well-being, these relations were negative, indicating that habitual reliance on this strategy can become a critical source as well as consequent of student ill-being. Moreover, our findings on relations with test scores show that managing anxiety via situation selection may negatively influence academic performance above and beyond prior achievement. Thus, while situation selection may potentially help to provide short-term emotional relief, it is likely detrimental when used habitually; it can take a toll on students' health and likely leads them to miss important academic opportunities for learning and success in the long run.

In contrast, bivariate linkages with correlates speak for adaptive qualities of *reappraisal* and *competence development*. For the most part, these strategies were positively linked to students' enjoyment, well-being, academic success, and perceived regulatory effectiveness, and negatively related to anxiety, boredom, and health problems. For enjoyment and boredom in particular, Study 3 provides support for the assumed reciprocal linkages between ER strategies and students' emotions: Habitual use of *reappraisal* and *competence development* were positively predicted by prior levels of enjoyment, and negatively by prior levels of boredom; furthermore, they were linked to higher levels of subsequent enjoyment and lower levels of boredom. These findings suggest that these strategies are helpful for sustaining habitual enjoyment and reducing boredom at university, but also highlight that prior experience of these emotions can promote or undermine the use of these strategies, respectively. For anxiety, patterns of relations were weaker but similar to boredom in terms of directions. In exploring relations with end-of-semester test scores, we found *reappraisal* was only significantly related to achievement when targeting boredom. *Competence development* strategies, however, were positively related with achievement for all three emotions.

All in all, our findings suggest that gearing students' ER habits towards using *reappraisal* and *competence development* may be one way to boost their well-being and health. For these strategies, we also found intriguing spillover effects on non-target emotions that warrant further inquiry. For instance, students' use of competence development strategies for upregulating enjoyment was associated with substantially lower levels of subsequent boredom, while use of this strategy for downregulating boredom coincided with higher levels of subsequent enjoyment. Moreover, using competence development for downregulating anxiety was linked to higher subsequent enjoyment and lower subsequent boredom (Study 3).

For *social support seeking*, *expression*, and *suppression* strategies, bivariate linkages with correlates were generally more mixed and less pronounced. This was particularly surprising for suppression: In contrast to prior research suggesting that habitual inhibition of emotions via suppression can impair psychological functioning and even amplify negative emotions (Gross, 2015), we did not find clear evidence for

maladaptive functions of this strategy. Individual differences in suppression of achievement emotions explained very little variation in students' emotions, well-being, perceived health, and academic success.

Expression, in contrast, which involves a kind of emotional indulgence, may be a powerful amplifier as well as outcome of both enjoyment and boredom in university settings: Higher levels of both emotions promote reliance on this strategy which, in turn, boosts subsequent enjoyment as well as boredom (see Study 3 for supporting evidence for reciprocal reinforcement over time). Expression was virtually unrelated to students' anxiety, suggesting that it may generally be less relevant for downregulating anxiety. Conversely, *social support seeking* emerged as a potentially important strategy for managing anxiety, but may be less relevant for managing enjoyment and boredom. However, our Study 3 findings show that while anxious students may more frequently seek social support, this strategy was also linked to higher subsequent anxiety. This points to a need for closer examination of what types of support students have at their disposal, from whom they solicit consolation, and how they can be supported effectively.

To probe the relative power of the six ER strategies for predicting subsequent emotions, well-being, and health problems, we conducted multiple latent regression analyses in Study 3. The findings confirm that it may be helpful to examine emotion-specific regulation, as different patterns emerged for the three emotions considered. While emotional *expression* of enjoyment may be particularly effective for promoting subsequent enjoyment and decreasing boredom, anxiety may be most effectively reduced via *reappraisal*, and boredom via *competence development*. As such, fostering ER in university students may be a matter of equipping them with broad repertoires of strategies that can be flexibly used in different situations and for different emotions (Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013).

Relations between ER strategies and correlates were similar across German and English university students, speaking to the assumption that basic mechanisms underlying psychological functioning, including linkages between regulatory strategies and antecedents or outcomes, should be relatively universal (Pekrun & Goetz, 2024; Vansteenkiste et al., 2020). Bearing in mind that our comparisons are descriptive in nature (see 6.3 for further discussion), we also encountered a few contextual differences. For example, gender differences in regulating achievement emotions were generally more pronounced in the German samples, and also aligned with gender differences observed in non-academic settings (McRae et al., 2008). As such, gender stereotypes that impact students' emotional self-regulation may be operating to different degrees across different academic contexts. We also observed that German and English university systems may differ in terms of administrative or study-related requirements which can influence students' options for enacting certain strategies, such as situation selection (e.g., via postponing exams or selecting courses). These requirements can impact both frequency of use as well as impact of strategies on emotions, well-being, and academic success. The results thus underscore the importance of considering demographic as well as contextual influences on students' ER in future research.

6.3. Limitations and directions for future research

The present studies document important linkages between students' ER and their emotions, well-being and health, and academic success. Nevertheless, several limitations need to be considered in interpreting the findings, and indicate directions for future research. First, building on the observed differences in German and English students' ER, more systematic cross-cultural research employing representative samples is needed. Our studies are among the first to explore similarities and differences in the regulation of achievement emotions across different academic contexts, but the findings remain descriptive at this stage. Because we contextualized the RAEQ to fit the respective university settings encountered by our German and English samples, we did not test for measurement invariance. Studies involving students from a

broader range of Western and non-Western cultures are needed to uncover contextual influences on students' ER; this could include creating culturally invariant (i.e., less contextualized) versions of the RAEQ and systematic assessment of the characteristics of academic environments.

Second, our data stem from three nonexperimental field studies that allowed for investigating structural properties and correlates of ER strategies (Fig. 2), but provide limited insight into causal mechanisms linking ER to antecedents and outcomes. Using experimental designs in which, for example, students' are randomly assigned to enact specific ER strategies (e.g., Gunzenhauser & Suchodoletz, 2014) could be one approach to examining causality. However, experimental designs are difficult to implement in naturalistic settings and thus often lack ecological validity (among other problems; e.g., Diener, Northcott, Zyphur, & West, 2022). Thus, as argued by Pekrun et al. (2023), we propose to consider longitudinal study designs involving multiple assessments and capturing different timeframes. Our prospective design in Study 3 takes a first step in this direction. This design allowed us to examine linkages between temporally ordered constructs, providing some insight into antecedent-outcome-relations, but could be expanded to combine long-term developmental assessments with situational assessments of ER (e.g., ER while studying vs. attending class or taking tests; Rottweiler et al., 2023) using experience sampling bursts. Such process-oriented designs could foster joint consideration of between- and within-person perspectives on ER, account for situation-specific as well as habitual use of regulatory strategies, and provide data for tracking short-versus long-term impact of strategy use (see, e.g., Gross, 2015, for a discussion). Thus, these designs could provide a starting point for disentangling the bidirectional relations between emotions and ER strategy use at different levels of analysis (i.e., momentary vs. habitual experience of emotions and use of ER strategies).

Furthermore, such designs allow for testing hypotheses on mechanisms that mediate relations of ER with antecedents and outcomes that have yet to be investigated. As shown in Fig. 2, for instance, linkages between antecedent-focused ER strategies that target earlier stages of the emotion-generative process (Gross, 2015) and students' achievement emotions are likely mediated by their impact on different antecedents of emotions, including the emotional characteristics of achievement situations, control-value appraisals, and academically relevant skills and competencies. However, empirical evidence supporting these mediational processes is lacking to date. Relatedly, these designs could be used to explore potential confounding variables driving relations between ER and its correlates, including students' cognitive abilities that may have positive effects on both their achievement as well as ER strategy use.

Third, we assessed ER strategy use via self-report. Self-report can be biased, but also has several advantages, especially regarding measuring regulatory strategies that involve covert processes (e.g., reappraisal, suppression; see Pekrun, 2020). As such, self-report constitutes the canonical mode of field-based inquiry into ER (Stanoi & Ochsner, 2024; Willroth & John, 2024). Moreover, objective measures, such as measures of electrodermal activity or heart rate, conflate use of regulatory strategies with emotional responding, making it difficult to specifically track regulatory processes (McRae, 2013). Nevertheless, future studies could explore the use of non-self-report measures to assess physiological parameters of emotional responding (Harley, Bouchet, Hussain, Azevedo, & Calvo, 2015) that accompany regulatory efforts.

Fourth, the findings provide insight into use and correlates of a range of different ER strategies, including strategies that have received scant attention to date, and covered the four major categories of strategies posited in CVT (Pekrun & Stephens, 2009). Nevertheless, the list of strategies included is by no means exhaustive. Future studies could examine the relevance of additional strategies, such as attentional deployment or acceptance (Naragon-Gainey, McMahon, & Chacko, 2017), for regulating achievement emotions in educational settings, perhaps in conjunction with different regulatory goals that students may be pursuing. In this research, we focused on prohedonic strivings, but

students' ER may also be driven by other goals, including instrumental performance or social goals (see also Tamir, 2016; Tamir, Vishkin, & Gutentag, 2020). Moreover, in addition to asking for frequency of strategy use, future research should also explore the role of the quality of strategy implementation (see, e.g., recent findings highlighting the importance of application quality of strategies for regulating academic motivation; von der Mülbe, Rinas, Dresel, & Stockinger, 2024). Students may use certain strategies frequently, but ineffectively, which may help explain some of the associations between habitual ER and emotions, well-being, and health observed in the present studies.

Finally, to promote integrative perspectives on components of students' self-regulation (Stockinger, Nett, & Dresel, 2025; Kim, Brady, & Wolters, 2020), future research should also examine how efforts to manage emotions may tie in with meta-/cognitive and motivational regulation. Effective self-regulation likely involves simultaneous monitoring and regulation of these subcomponents rather than isolated processes, and they likely influence each other. For example, recent findings suggest that university students' motivational regulation is closely connected to their achievement emotions (von der Mülbe, Rinas, Dresel, & Stockinger, 2024), and that strategies for regulating achievement emotions and motivation are functionally similar (Stockinger, Nett, & Dresel, 2025; Webster & Hadwin, 2015). Understanding students' regulation of achievement emotions may thus entail consideration of its interplay with other components of self-regulation.

6.4. Conclusion: Implications for educational practice

Bearing in mind the work ahead, the present research discloses a core message for educators and policy makers, especially in light of the increasing concerns about postsecondary students' mental health: How students deal with their achievement-related emotions matters profoundly, not only for their academic performance, but also for their personal well-being and physical health. Accordingly, tuning into students' emotional self-regulation could provide an important means for promoting well-being in this population. Fundamentally speaking, students should have a broad repertoire of regulatory strategies at their disposal, but should be cautioned against the habitual reliance on situation selection strategies, particularly regarding long-term effects of procrastination, skipping class, or avoiding challenges: While this strategy may feel good in the moment, it is likely of little use in effectively resolving emotional difficulties at university. In contrast, students may particularly benefit from building habits that involve *reappraisal* and *competence development* strategies. As students may be differentially able to execute these strategies effectively or lack awareness of the potential emotional benefits of strategies to improve study skills and academic performance (i.e., *competence development* strategies), this may require training and/or professional counseling. Moreover, to facilitate adaptive pathways and enable students to build lasting, adaptive ER habits, the importance of emotions and emotion regulation should already be foregrounded in earlier stages of education.

CRedit authorship contribution statement

Kristina Stockinger: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Markus Dresel:** Writing – review & editing, Resources, Methodology. **Herbert W. Marsh:** Writing – review & editing, Methodology, Formal analysis. **Reinhard Pekrun:** Writing – review & editing, Project administration, Methodology, Formal analysis, Data curation, Conceptualization.

Conflict of interest

We have no known conflict of interest to disclose.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.learninstruc.2025.102089>.

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