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Emotion regulation strategies as mediators in the relation between Big Five personality traits and achievement emotions: Cross-cultural evidence from university students

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ABSTRACT

Personality traits and emotion regulation (ER) are key antecedents of emotions in learning contexts. Nevertheless, little is known about the possible mediating role of ER in the relation between the Big Five (BF) traits and achievement emotions (AEs). Considering the Control-Value Theory as the main framework, we examined the mediation of behavioral (Actively Approaching, Withdrawal) and cognitive (Refocus on Planning, Catastrophizing) ER strategies in the relation between the BF traits and 10 study-related AEs. We recruited 754 university students from Italy and the United Kingdom. Using path analyses (PAs), we found that Actively Approaching mediated the relation of Extraversion, Agreeableness, Negative Emotionality, and Open-Mindedness with pride and relaxation. Withdrawal mediated the relation of Extraversion and Negative Emotionality with boredom. Catastrophizing mediated the relation between Negative Emotionality and hope, anxiety, anger, and hopelessness. Through multi-group PAs, we observed some country differences in the relation of the BF traits with, respectively, Actively Approaching and Catastrophizing, and three negative emotions. These findings can serve as the basis for developing evidence-based interventions that take into account personality differences and/or influence ER strategies to improve students' AEs.

1. Introduction

Personality, emotion regulation (ER), and achievement emotions (AEs) are well-established constructs in psychological research, yet their interrelations have rarely been examined within learning contexts. We addressed four gaps in existing research, characterized by a lack of knowledge (a) on the mediational role of ER strategies in the relation between Big Five (BF) personality traits and AEs, by (b) examining relatively disregarded ER strategies, (c) focusing on a range of positive and negative AEs, and (d) investigating the universality of such relations across individual (gender) and contextual (country) factors. Therefore, we investigated how BF traits relate to study-related AEs, considering the mediation of behavioral and cognitive ER strategies, and involving university students from Italy and the United Kingdom (UK).

1.1. Big Five personality traits

Personality traits are enduring patterns of thoughts, feelings, and behaviors that characterize an individual and distinguish one person from another over time and situations (Soto & John, 2017). According to one of the most widely-used frameworks, the BF model (Goldberg, 1993), there are five major traits that together capture the fundamental structure of human personality: Extraversion (being sociable and assertive), Agreeableness (showing compassion and respect toward others), Conscientiousness (being organized), Negative Emotionality (or Neuroticism; being emotionally unstable with a tendency to feel negative emotions), and Open-Mindedness (being creative and intellectually curious; Soto & John, 2017). For the sake of clarity, we adopt these five labels, acknowledging that alternative terms also exist.

The impact of BF traits on affect has long been recognized, as indicated by classical meta-analyses reporting that personality predicts

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subjective well-being (in terms of affect, happiness, life satisfaction, and quality of life), with an undesirable impact for Negative Emotionality and the opposite for the other traits (e.g., Steel et al., 2008). Additionally, the relevance of BF traits for academic settings has been well-documented. A meta-analysis of university students found positive correlations between Agreeableness, Conscientiousness, and Open-Mindedness and academic achievement; for Extraversion, correlations were negative in individualistic contexts and positive for education majors; and for Negative Emotionality, they were positive for freshmen and sophomores (Chen et al., 2025).

1.2. Emotion regulation strategies

ER encompasses conscious and unconscious efforts to modulate which emotions are experienced, when they occur, and how they are internally processed or externally expressed (Gross, 2015), through behavioral or cognitive strategies (Garnefski & Kraaij, 2007; Kraaij & Garnefski, 2019). Gross's (2015) Process Model of Emotion Regulation (PMER) describes a five-phase process of emotion origin, including situation selection, situation modification, attentional deployment, cognitive change, and response modulation. The PMER, also in its applications to the academic context (see the Emotion Regulation in Achievement Situations model, ERAS; Harley et al., 2019), fostered research on two ER strategies, reappraisal and suppression, with the former being adaptively associated with well-being and mental health, and the latter showing the opposite pattern. Recently, an expanding body of literature has examined a larger range of ER strategies for learning. A meta-analysis also revealed significant associations between ER and achievement, with positive effects for strategies such as problem-solving and negative effects for others, including avoidance (Romo et al., 2025).

Beyond the intrinsic relevance of ER for learning, the growing body of research on this topic is also related to the diffusion of models such as the ERAS and to the availability of instruments assessing a relatively large variety of strategies pertaining to different PMER phases, such as the *Behavioral Emotion Regulation Questionnaire* (BERQ; Kraaij & Garnefski, 2019) and the *Cognitive Emotion Regulation Questionnaire* (CERQ; Garnefski & Kraaij, 2007). On the one hand, students can implement specific behaviors related to problem-solving to actively face a stressful event, for example, during the situation modification phase. Alternatively, they could withdraw from situations and people during the situation selection or even the response modulation phase. These two strategies – labeled Actively Approaching and Withdrawal in the BERQ – resulted in adaptive or maladaptive outcomes, respectively, in terms of passion for studying and emotional reactivity among university students (Mudło-Głagolska & Larionow, 2023). On the other hand, students could react by thinking about steps for handling the stressful event or by highlighting the extreme negativity of their experiences, for example, during the attentional deployment or the cognitive change phase. For university students, these two strategies – labeled Refocus on Planning and Catastrophizing in the CERQ – were distinguished as respectively adaptive or maladaptive, in terms of their relations with test anxiety and post-traumatic stress symptoms (Kamel, 2018; Yang et al., 2022). Although some strategies are generally considered beneficial, while others detrimental, adaptive ER is increasingly understood not merely as the use of specific strategies, but as resulting from a flexible match between the characteristics of individuals, contexts, and situational goals (Wright et al., 2025).

1.3. Achievement emotions

AEs are multi-faceted affective processes occurring "in response to events and actions that are judged according to competence-based standards" (Pekrun et al., 2023, p. 146). In the last two decades, research in this field has been dominated by the Control-Value Theory (CVT; Pekrun, 2006; Pekrun et al., 2023), which provides three dimensions to define AEs: valence (positive/pleasant versus negative/unpleasant), physiological arousal (activating versus deactivating), and object focus (activity versus outcome). The CVT also targets AEs' network of factors, comprising proximal and distal antecedents as well as academic outcomes.

Proximal antecedents include control and value beliefs, influenced by more distal antecedents that can also directly impact AEs. Among them are both personality traits (Pekrun, 2006; Pekrun et al., 2023) and ER strategies (Harley et al., 2019; Wright et al., 2025), with the latter having both a distal and proximal effect. AEs influence academic outcomes, generally positively for pleasant emotions and negatively for unpleasant emotions (Pekrun, 2006; Pekrun et al., 2023; for a meta-analysis, see Camacho-Morles et al., 2021). The CVT core assumptions pertain to the context-specificity of AEs (i.e., varying across different academic contexts, such as the study, class, and exam settings), reciprocal causation among key constructs, and the universality of functional relations between these constructs across individual factors, such as gender, and contextual factors, including country (Pekrun, 2006; Pekrun et al., 2023).

1.4. The mediating role of emotion regulation strategies in the relation between Big Five personality traits and achievement emotions

Notwithstanding the relevance for learning of the interrelations between BF traits, ER, and emotions, attention has rarely been paid to the mediation of ER strategies in academic contexts. In a study involving 17- to 25-year-olds, participants with higher Negative Emotionality experienced stronger test anxiety, and the effect was mitigated by cognitive reappraisal (Xu et al., 2024). Among university students, de la Fuente et al. (2024) found that Extraversion and Conscientiousness were positively related to study-related self-regulation (including goal-setting planning) and problem-focused coping; they were also associated positively with a composite score of positive AEs and negatively with a composite score of negative AEs. Agreeableness and Negative Emotionality were linked negatively to self-regulation and positively to emotion-focused coping, as well as positively to negative AEs. In turn, self-regulation was linked positively to positive AEs and negatively to negative AEs. However, the authors did not elaborate further about the mediation of self-regulation. Therefore, the nature of the mediating role of a relatively large number of ER strategies in the relation between personality and a range of AEs remains an underexplored issue.

Nevertheless, previous research offers insights regarding the direct relations between these three constructs. Beyond the cited findings on the relation between personality and well-being (Steel et al., 2008), a 30-year meta-analysis revealed that test anxiety had its strongest positive relation with Negative Emotionality and a small negative relation with Conscientiousness (von der Embse et al., 2018). Pekrun et al. (2023) indicated that university students high in Extraversion, Agreeableness, Conscientiousness, and Open-Mindedness generally experienced more positive AEs and fewer negative AEs, and vice versa for Negative Emotionality. However, they also found exceptions to this pattern: anxiety, shame, and disappointment were positively associated with Extraversion, and Negative Emotionality showed a positive link to relief. Meta-analytical findings about the relation between personality and ER revealed that higher Extraversion, Agreeableness, Conscientiousness, and Open-Mindedness, and lower Negative Emotionality were linked positively to adaptive strategies, such as problem-solving (e.g., designing and implementing plans to solve problems), and negatively to maladaptive ones, like avoidance (e.g., withdrawing from social stimuli in the face of difficult events; Barańczuk, 2019). Overall, this may be attributable to the combined effects of individuals' personality traits on the effectiveness of different socialization practices and on their activation (Barańczuk, 2019). Finally, while models such as the ERAS have stimulated research on ER and AEs, knowledge about a wide range of both strategies and emotions remains lacking. With university students, Stockinger et al. (2025) found that several learning-related ER strategies

were linked to their emotions, well-being, health, and academic achievement. Students who resorted more to situation selection – operationalized in part by items about withdrawal from social interactions – experienced higher anxiety and boredom, while those using competence development – including some items pertaining to making and implementing plans – felt more enjoyment and less anxiety and boredom.

To sum up, sparse data on university students suggest that ER strategies may serve as potential mediating processes in the relation between BF traits and AEs. Moreover, previous findings document how these three constructs are directly linked to one another. However, there remains a paucity of knowledge about such a role in academic contexts.

1.5. The current study

We studied the mediation of ER strategies in the relation between BF traits and study-related AEs in university students. We assessed four relatively underexplored ER strategies: Actively Approaching, Withdrawal, Refocus on Planning, and Catastrophizing, balancing domain (behavioral, cognitive), reference to different phases in the PMER/ERAS, and adaptiveness (adaptive, maladaptive). In line with the context-specific nature of AEs (Pekrun, 2006; Pekrun et al., 2023), we measured them in the study setting (i.e., asking participants to think about when studying for their university courses), traditionally less investigated compared to evaluative settings such as exams (von der Embse et al., 2018).

1.5.1. Aim 1

Based on the CVT, we tested two models examining the relation between BF traits and AEs, alongside the mediation of ER strategies.

1.5.1.1. Hypothesis 1a. We hypothesized that BF traits were related to ER strategies. We expected that students with higher scores for Extraversion, Agreeableness, Conscientiousness, and Open-Mindedness would use adaptive strategies (Actively Approaching, Refocus on Planning) more frequently to deal with negative events, rather than maladaptive strategies (Withdrawal, Catastrophizing), and vice versa for Negative Emotionality.

1.5.1.2. Hypothesis 1b. We hypothesized that ER strategies were associated with AEs. We expected that students who tend to use adaptive strategies experience more intense positive emotions (enjoyment, pride, hope, relief, and relaxation) and less intense negative emotions (anxiety, anger, shame, hopelessness, and boredom), and vice versa for maladaptive strategies.

1.5.1.3. Hypothesis 1c. We hypothesized that BF traits impacted AEs. We expected that students with higher scores for Extraversion, Agreeableness, Conscientiousness, and Open-Mindedness would feel more intense positive emotions and less intense negative emotions, and vice versa for Negative Emotionality. We examined whether BF traits influenced AEs directly or indirectly via ER strategies.

1.5.2. Aim 2

We investigated the models' structural invariance across gender (as a social construct and identity; American Psychological Association, 2024) and country to test CVT assumptions about the universality of the relations between AEs and their antecedents.

1.5.2.1. Hypothesis 2. We expected the tested models to be invariant across gender (males, females) and country (Italy, UK), i.e., that the relations between the variables remained unchanged.

2. Method

2.1. Participants and procedure

We recruited a convenience sample of 754 university students attending university in Italy ($n = 501$; $M_{age} = 22.62$, $SD = 4.89$, range: 19–59; 86.03% females) or in the UK ($n = 253$; $M_{age} = 21.15$, $SD = 4.57$, range: 18–54; 76.68% females). Six hundred and thirty-two (83.82%) students were enrolled in a Bachelor's degree, 112 (14.85%) in a Master's degree, and 10 (1.33%) did not specify their study level. Most of them ($n = 427$, 56.63%) were attending a course in the field of Psychology. The remaining were distributed across a wide range of university courses.

The research was approved by the Ethics Committee of the Department of Human Sciences at the University of Verona, Italy (protocol number 404224, dated 10/10/2023). After giving informed consent, students completed an online survey in Italian (Italy) or English (UK). They were recruited during on-site classes or meetings at universities in the Veneto region (Italy) or Lancashire (UK), and asked to share the link with peers at their own university or at other universities. We used LimeSurvey in Italy and Qualtrics in the UK.

2.2. Measures

2.2.1. Big Five personality traits

We assessed students' personality using the *Big Five Inventory-2* (BFI-2; Soto & John, 2017; Burro et al., 2025), which comprises 60 items on a 5-point scale (1 = *Strongly disagree*, 5 = *Strongly agree*). The BFI-2 measures five traits (i.e., "I am a person who…"): Extraversion (e.g., "Is outgoing, sociable"), Agreeableness (e.g., "Is polite, courteous to others"), Conscientiousness (e.g., "Keeps things neat and tidy"), Negative Emotionality (e.g., "Often feels sad"), and Open-Mindedness (e.g., "Values art and beauty"). Four items were reverse-coded. For each trait, we summed the responses. Higher scores indicated greater correspondence of each trait with participants' personal characteristics. Cronbach's (1951) alpha (α) ranged from 0.66 to 0.82, and McDonald's (1999) omega (ω) ranged from 0.66 to 0.83, suggesting good internal consistency (Table 1).

2.2.2. Emotion regulation strategies

The students were asked how much various ER strategies described them when they had to deal with a negative or unpleasant event. Items were rated on a 7-point scale (1 = *Not at all*, 5 = *Extremely*). We used 8 items from the BERQ (Kraaij & Garnefski, 2019) to measure two behavioral strategies, Actively Approaching (e.g., "I get to work on it") and Withdrawal (e.g., "I avoid other people"). We obtained the Italian version through back-translation (i.e., the second author translated the items from English to Italian; the first author translated them back into English; discrepancies were discussed to obtain the final Italian version). We utilized 8 items from the CERQ (Cerolini et al., 2022; Garnefski & Kraaij, 2007) to assess two cognitive strategies, Refocus on Planning (e.g., "I think about a plan of what I can do best") and Catastrophizing (e.g., "I keep thinking about how terrible it is what I have experienced"). For each strategy, we summed the responses. Higher scores indicated greater alignment between individuals' responses and the use of each ER strategy. Internal consistency was good (α = 0.78–0.91, ω = 0.80–0.91; Table 1).

2.2.3. Achievement emotions

We used a brief version of the *Achievement Emotions Adjective List* (AEAL; Raccanello et al., 2022a, Raccanello et al., 2022b) to assess the extent to which students experienced 10 AEs while studying. It comprises 10 adjectives about five positive emotions, i.e., enjoyment ("Happy"), pride ("Proud"), hope ("Hopeful"), relief ("Relieved"), and relaxation ("Calm"), and five negative emotions, i.e., anxiety ("Anxious"), anger ("Angry"), shame ("Ashamed"), hopelessness ("Sad"), and boredom ("Bored"), rated on a 7-point scale (1 = *Not at all*,

Table 1
Descriptive statistics, reliability indexes, and factor loadings for Big Five personality traits, emotion regulation strategies, and achievement emotions.

	Number of Items	Mean	*SD*	95% CI	Skewness	Kurtosis	α/ω	Factor loadings
Extraversion	3	8.98	3.01	[8.77, 9.20]	−0.05	−0.83	0.75/0.76	0.59–0.88
Agreeableness	3	13.40	1.48	[13.30, 13.51]	−0.97	1.23	0.66/0.66	0.69–0.83
Conscientiousness	3	10.03	3.19	[9.80, 10.25]	−0.21	−0.84	0.82/0.83	0.70–0.92
Negative Emotionality	3	9.63	3.00	[9.41, 9.84]	−0.15	−0.70	0.78/0.81	0.53–0.91
Open-Mindedness	3	11.46	2.69	[11.27, 11.65]	−0.63	−0.16	0.73/0.75	0.57–0.85
Actively Approaching	4	13.54	3.83	[13.26, 13.81]	0.16	−0.10	0.90/0.90	0.82–0.93
Withdrawal	4	12.05	4.56	[11.73, 12.38]	0.18	−0.58	0.91/0.91	0.82–0.94
Refocus on Planning	4	14.40	3.69	[14.14, 14.67]	0.03	0.26	0.90/0.90	0.80–0.91
Catastrophizing	4	9.08	3.61	[8.83, 9.34]	0.70	0.42	78./0.80	0.50–0.90
Enjoyment	1	4.31	1.27	[4.22, 4.40]	−0.24	−0.07	–	–
Pride	1	4.57	1.47	[4.46, 4.67]	−0.41	−0.35	–	–
Hope	1	4.67	1.29	[4.58, 4.76]	−0.47	0.04	–	–
Relief	1	3.46	1.46	[3.35, 3.56]	0.03	−0.59	–	–
Relaxation	1	4.18	1.32	[4.08, 4.27]	−0.19	−0.14	–	–
Anxiety	1	4.52	1.57	[4.40, 4.63]	−0.32	−0.57	–	–
Anger	1	2.08	1.33	[1.99, 2.18]	1.36	1.46	–	–
Shame	1	1.93	1.30	[1.84, 2.03]	1.46	1.59	–	–
Hopelessness	1	2.57	1.41	[2.47, 2.67]	0.84	0.18	–	–
Boredom	1	3.43	1.26	[3.34, 3.52]	0.58	0.03	–	–

Note. 95% CI = 95% confidence interval; *SD* = standard deviation; α = Cronbach's alpha; ω = McDonald's omega.

7 = *Extremely*). Higher scores indicated greater experience with each AE while studying.

2.3. Data analysis

Using R software (Version 4.5.0; lavaan package; Rosseel, 2012), we ran three confirmatory factor analyses (CFAs) to verify the five-factor structure of the BFI-2 and the two-factor structure of BERQ and CERQ (diagonally weighted least squares estimator, DWLS) – the two strategies covaried. As a preliminary check, we also explored potential age and degree level differences in ER and AEs. We conducted three linear mixed models (LMMs). We considered age as a continuous fixed effect; degree level (Bachelor's, Master's) as a categorical fixed between-subject effect; and participants as the random effect. For the LMM on ER, we also added strategy type (Actively Approaching, Withdrawal, Refocus on Planning, and Catastrophizing) as a categorical fixed within-subject effect; for the LMMs on AEs, we added, respectively, positive AE type (enjoyment, pride, hope, relief, and relaxation) and negative AE type (anxiety, anger, shame, hopelessness, and boredom). The dependent variables were, respectively for each of the three models, the scores of the four ER strategies, of positive AEs, and of negative AEs. We used the Gaussian family and the identity link-function.

For aim 1, we conducted two path analyses (PAs; Maximum Likelihood estimator, ML) to examine the relations between BF traits and emotions – separately for positive and negative emotions – investigating the mediation of ER. We included all variable links and covariances between adaptive and maladaptive strategies, as well as between AEs (see the note in Fig. 1). As a robustness check, we conducted the two PAs including age and degree level as covariates. However, the relations between the three constructs in the PAs did not vary as a function of these covariates. Therefore, for parsimony, we report only the findings from the PAs without covariates. We considered βs ≤ 0.05 as small and not meaningful, 0.05 < βs ≤ 0.10 as small, 0.10 < βs ≤ 0.25 as moderate, and βs > 0.25 as large (Keith, 2019). For CFAs and PAs, we examined the comparative fit index (CFI), the Tucker-Lewis index (TLI), the root mean square error of approximation (RMSEA), and the square root mean residual (SRMR) as model-fit indexes. Models were acceptable when CFI and TLI > 0.90 and preferably close to 0.95, and RMSEA and SRMR <0.10 and preferably close to 0.06 (Hu & Bentler, 1999). Although no universally accepted guidelines exist for sample size in PA, prior literature suggests that approximately 200 observations per group are generally adequate, whereas samples below 100 may compromise the stability of parameter estimates (Hair et al., 2019; Kline, 2023; Newsom, 2025). Moreover, our sample size was also in line with Kline's (2023) indications for PA sample size, with a ratio of observations to parameters of 9:1 (754 participants for 86 estimated parameters).

For aim 2, we ran four multi-group PAs to study structural invariance across gender and country. We compared an unconstrained model (with path coefficients freely estimated in each group) to a constrained model (with path coefficients forced to be equal across groups), calculating the chi-square. Students who indicated "Other" (n = six) and "I prefer not to answer" (n = five) were excluded from the models. Even though the sample sizes in these analyses were smaller than in the previous PAs, in all cases group sizes were above the 100 threshold suggested in the literature (Hair et al., 2019; Kline, 2023; Newsom, 2025).

3. Results

3.1. Preliminary analyses

The BFI-2 CFA had an unsatisfactory fit (CFI = 0.845, TLI = 0.839, RMSEA = 0.102, SRMR = 0.103). After selecting three items for each trait (based on factor loadings, cross-loadings, and R^2), we obtained a 15-item five-factor model with a good fit (CFI = 0.975, TLI = 0.970, RMSEA = 0.074, SRMR = 0.077). For ER, each model had a good fit (BERQ/CERQ: CFI = 0.999/0.995, TLI = 0.998/0.993, RMSEA = 0.050/0.077, SRMR = 0.001/0.049).

The first LMM showed no significant differences in ER strategies according to age or degree level. In the LMM on positive AEs, there was a significant age × AE type interaction, $\chi^2(4, N = 754) = 11.76$, $p = .019$. Simple slope analyses indicated that, with increasing age, only relief diminished, $z = -2.13$, $p = .034$. In the LMM on negative AEs, a significant degree level × AE type interaction, $\chi^2(4, N = 754) = 11.76$, $p = .019$, emerged. A Bonferroni post-hoc test, $z = -1.97$, $p = .048$, indicated that anger was lower for Bachelor's ($M = 2.05$, $SD = 1.32$, 95% CIs [1.95, 2.15]) compared to Master's students ($M = 2.27$, $SD = 1.39$, 95% CIs [2.01, 2.53]). On the whole, these analyses revealed no age or degree differences in ER strategies, serving as mediators in subsequent PAs, and only marginal differences in AEs.

See Table 1 for descriptive statistics, internal consistency, and factor loadings, and Table 2 for Pearson's intercorrelations.

3.2. Path analyses

PAs had a good fit (positive/negative emotions: CFI = 0.997/0.997, TLI = 0.944/0.945, RMSEA = 0.042/0.042, SRMR = 0.012/0.012). We reported the paths in Fig. 1. First (see Fig. 1.a1 and b1), Extraversion, Agreeableness, Conscientiousness, and Open-Mindedness were related

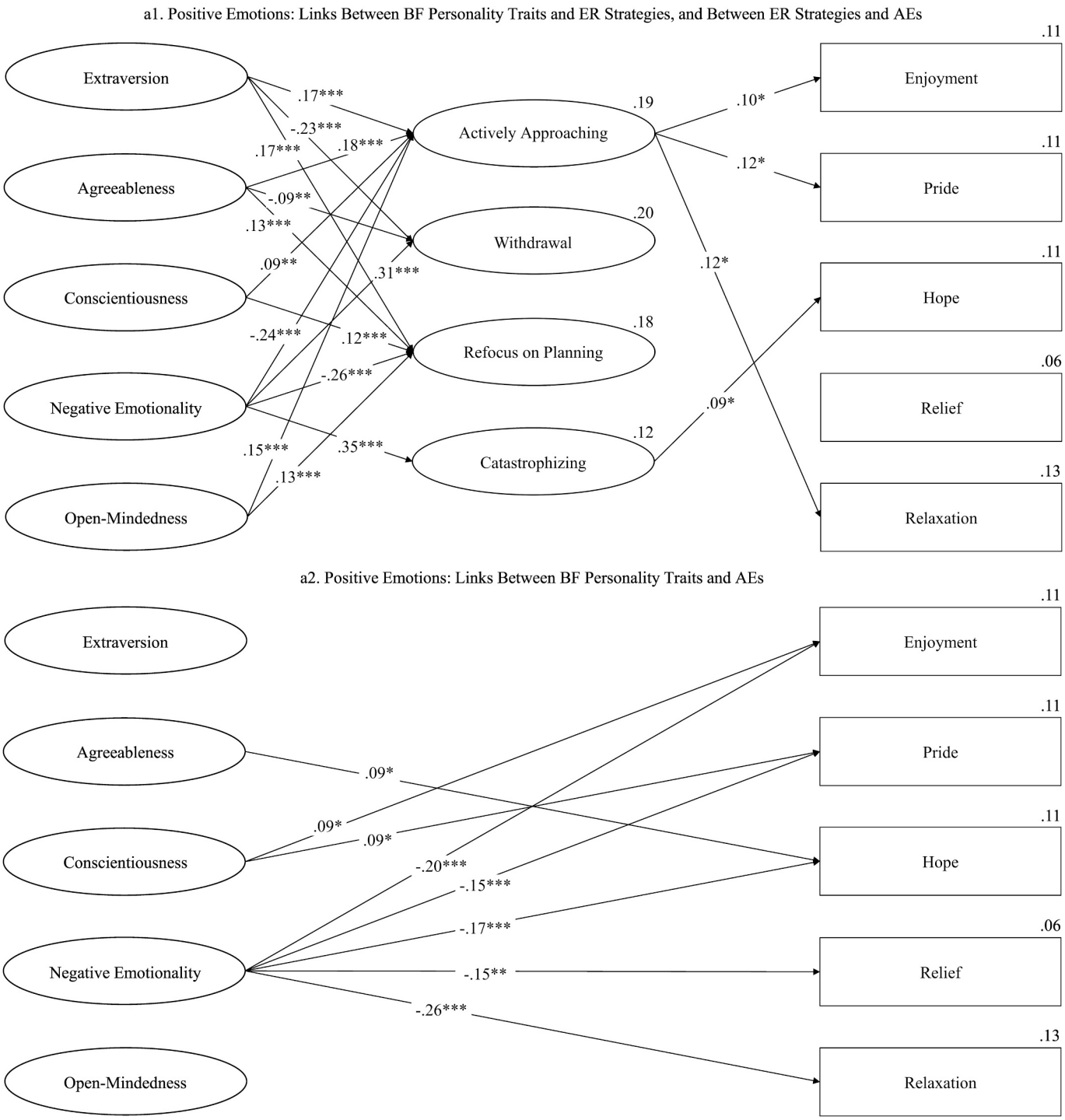

Fig. 1. Two path models representing the associations between Big Five personality traits, emotion regulation strategies, and achievement emotions, for (a) positive and (b) negative emotions. to avoid visual overcrowding, links between Big Five personality traits and emotion regulation strategies, and between emotion regulation strategies and achievement emotions (a1, b1), and links between Big Five personality traits and achievement emotions (a2, b2), are reported separately.
Note. Values above the arrows denote standardized beta coefficients (β); for the sake of brevity, only significant paths are represented. Values reported in the upper right of emotion regulation strategies and achievement emotions represent explained variance (R^2). Covariance was 0.61 ($p < .001$) between the two adaptive emotion regulation strategies and 0.17 ($p < .001$) between the two maladaptive emotion regulation strategies. For positive emotions, covariances ranged from 0.15 to 0.50 ($p < .001$); for negative emotions, covariances ranged from 0.07 to 0.44 ($p < .001$, except for the lower covariance for which $p = .043$). *$p < .05$. **$p < .01$. ***$p < .001$.

positively, and Negative Emotionality negatively, to Actively Approaching and Refocus on Planning. Extraversion and Agreeableness were negatively linked to Withdrawal. Negative Emotionality was positively associated with Withdrawal and Catastrophizing. Second (see Fig. 1.a1 for positive AE and Fig. 1.b1 for negative AE), there were positive associations of Actively Approaching with enjoyment, pride, and relaxation; of Withdrawal with boredom; and of Catastrophizing with hope, anxiety, anger, and hopelessness. Third (see Fig. 1.a2 for

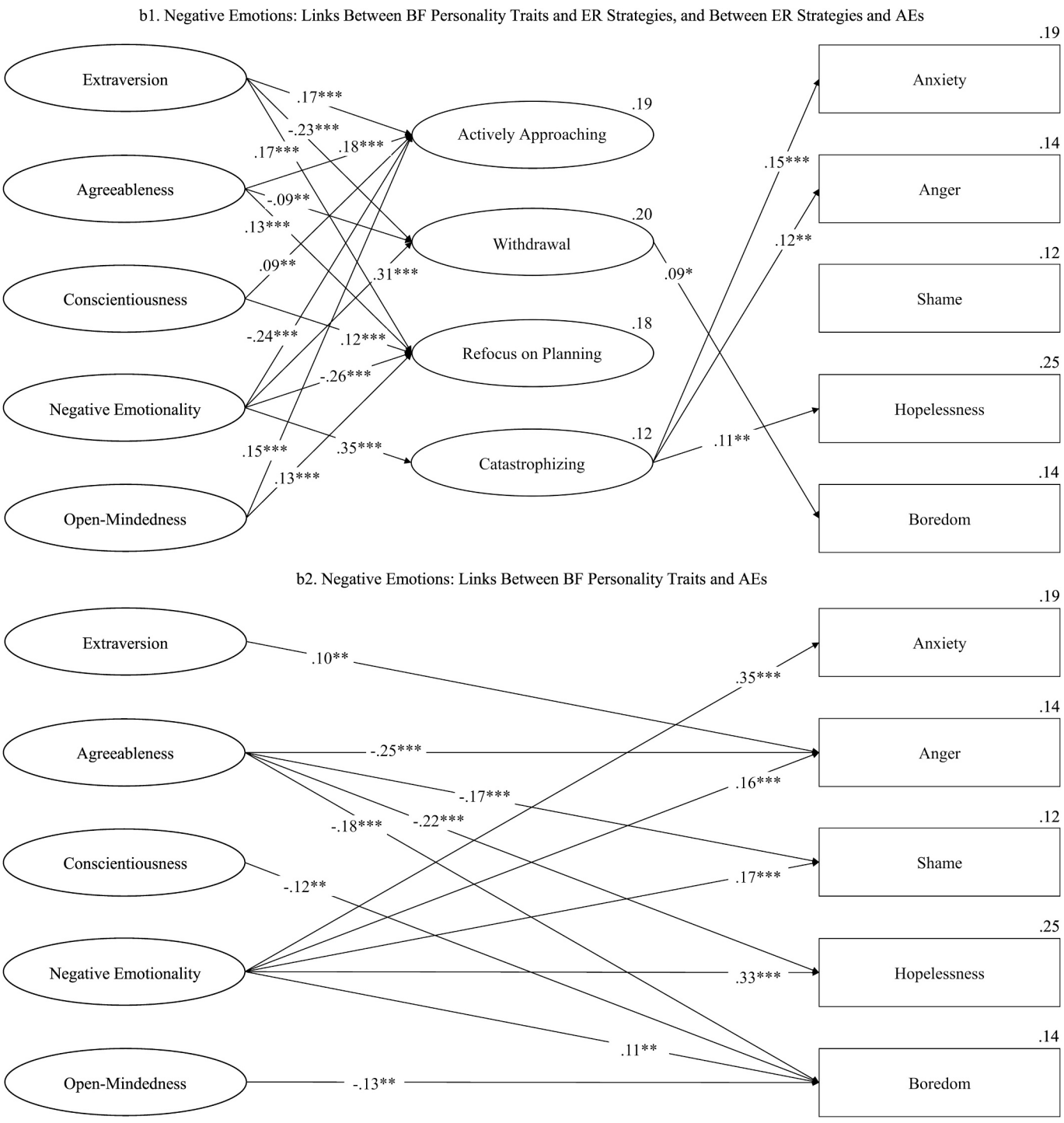

Fig. 1. (*continued*).

positive AE and Fig. 1.b2 for negative AE), Extraversion was positively related to anger. Agreeableness was related positively to hope and negatively to anger, shame, hopelessness, and boredom. Conscientiousness was related positively to enjoyment and pride, and negatively to boredom. Negative Emotionality was related negatively to positive emotions and positively to negative emotions. Open-Mindedness was negatively related to boredom.

The links between BF traits and strategies were small to large, while those between strategies and emotions were small to moderate (see Fig. 1.a1 and b1). The links between BF traits and emotions were small to large (see Fig. 1.a2 and b2).

Considering indirect effects (Table 3), Actively Approaching mediated the relation of four BF traits (except Conscientiousness) with pride and relaxation (with negative estimates only for Negative Emotionality). Withdrawal mediated the relation of Extraversion and Negative Emotionality with boredom (with a negative estimate for Extraversion). Catastrophizing mediated the relation of Negative Emotionality with hope, anxiety, anger, and hopelessness (with positive estimates). All the mediations were total except those involving Negative Emotionality, which were partial.

The multi-group PAs confirmed structural invariance across gender for all emotions and across countries for positive emotions; however, for

Table 2
Pearson's intercorrelations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Extraversion	–																	
2. Agreeableness	−0.04	–																
3. Conscientiousness	−0.02	0.15***	–															
4. Negative Emotionality	−0.26***	−0.09*	−0.13***	–														
5. Open-Mindedness	0.07	0.18***	−0.08*	0.04	–													
6. Actively Approaching	0.23***	0.24***	0.13***	−0.31***	0.18***	–												
7. Withdrawal	−0.31***	−0.11**	−0.08*	0.38***	0.03	−0.22***	–											
8. Refocus on Planning	0.24***	0.18***	0.16***	−0.32***	0.14***	0.68***	−0.25***	–										
9. Catastrophizing	−0.04	−0.06	−0.01	0.33***	−0.04	−0.16***	0.25***	−0.15***	–									
10. Enjoyment	0.15***	0.08*	0.13***	−0.26***	0.08*	0.22***	−0.14***	0.21***	−0.06	–								
11. Pride	0.14***	0.09*	0.14***	−0.23***	0.05	0.25***	−0.13***	0.24***	−0.04	0.55***	–							
12. Hope	0.12***	0.16***	0.11**	−0.23***	0.09*	0.23***	−0.15***	0.23***	−0.02	0.45***	0.46***	–						
13. Relief	0.04	−0.03	0.10**	−0.18***	−0.02	0.14***	−0.11**	0.14***	−0.02	0.48***	0.41***	0.34***	–					
14. Relaxation	0.09*	0.10**	0.11**	−0.32***	0.05	0.24***	−0.10**	0.21***	−0.17***	0.36***	0.29***	0.23***	0.31***	–				
15. Anxiety	−0.12***	−0.01	−0.06	0.41***	0.04	−0.17***	0.19***	−0.14***	0.27***	−0.13***	−0.12***	−0.05	−0.16***	−0.45***	–			
16. Anger	0.05	−0.29***	−0.08*	0.21***	−0.06	−0.11**	0.13***	−0.12**	0.19***	−0.23***	−0.19***	−0.19***	−0.05	−0.27***	0.22***	–		
17. Shame	−0.12***	−0.20***	−0.05	0.26***	−0.07	−0.16***	0.17***	−0.19***	0.17***	−0.14***	−0.24***	−0.21***	−0.01	−0.18***	0.22***	0.37***	–	
18. Hopelessness	−0.06	−0.28***	−0.08*	0.41***	−0.04	−0.22***	0.23***	−0.24***	0.25***	−0.34***	−0.27***	−0.24***	−0.14***	−0.37***	0.38***	0.52***	0.43***	–
19. Boredom	−0.02	−0.26***	−0.16***	0.19***	−0.16***	−0.20***	0.17***	−0.17***	0.14***	−0.41***	−0.33***	−0.23***	−0.18***	−0.22***	0.14***	0.35***	0.24***	0.42***

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

the PA on negative emotions across countries, the chi-square of the multi-group comparison was statistically significant (Table 4). Comparing fully and partially constrained models (Table 5), we found that the positive links of Extraversion with Actively Approaching and Catastrophizing, and of Negative Emotionality with shame and hopelessness, were stronger for the UK than for Italy. Finally, the link between Conscientiousness and shame was positive for Italy and negative for the UK, and vice versa for the link between Conscientiousness and anger.

4. Discussion

We examined how four ER strategies that university students can resort to during different phases of the PMER/ERAS (Gross, 2015; Harley et al., 2019) can mediate the relation between BF personality traits (Soto & John, 2017) and 10 study-related AEs (Pekrun, 2006; Pekrun et al., 2023; Raccanello et al., 2022a, 2022b). Our findings confirm the general adaptive role of four out of five BF traits and the general maladaptive role of Negative Emotionality, as typically documented for a range of outcomes unrelated to ER or AEs (Chen et al., 2025; Steel et al., 2008; von der Embse et al., 2018). The added value of this work lies in extending such knowledge to emotional processes triggered by the study setting, which is crucial for both students' achievement and well-being.

In line with a meta-analysis about BF traits and ER (Barańczuk, 2019), we found that more neurotic students were less likely to use problem-solving strategies, in turn preferred by students high in the other traits; moreover, less extraverted and agreeable students, and more neurotic ones, favored Withdrawal, with the latter students more likely to engage also in Catastrophizing (confirming Hypothesis 1a). This evidence highlights the strongly maladaptive role of Negative Emotionality, alongside the social aspects of three (Extraversion, Agreeableness, and Negative Emotionality) of the five traits, which were associated with the most socially-oriented strategy, Withdrawal.

Coherent with the sparse evidence on ER and emotions in university students (Kamel, 2018; Mudło-Głagolska & Larionow, 2023; Stockinger et al., 2025; Yang et al., 2022), our analyses showed that Actively Approaching (behavioral) was positively associated with enjoyment, pride, and relaxation; Withdrawal (behavioral) with boredom; and Catastrophizing (cognitive) with hope, anxiety, anger, and hopelessness (partially confirming Hypothesis 1b). These findings suggest that the cognitive ER strategies we considered may exert null or unpleasant consequences on emotions, while the two behavioral strategies appear to have a similar relevance, with opposite cascading effects in terms of emotional pleasantness. Moreover, the pattern of outcome-focused emotions associated with Catastrophizing suggests that dwelling on negative thoughts may be related to both the past (anger can be considered a retrospective emotion) and the future (hope, anxiety, and hopelessness can be considered prospective emotions).

Also broadly consistent with the rare previous literature on BF traits and AEs (Pekrun et al., 2023; von der Embse et al., 2018), Hypothesis 1c was partially confirmed, with direct significant links in the expected direction, except for more extraverted students who were more prone to feeling angry. This result could be due to the fact that studying is typically conducted individually, which may lead to frustration with a socially poor environment or dissatisfaction with prolonged solitary activities. Only for more neurotic students, the links with all emotions were significant, again indicating the pervasive negative effects of Negative Emotionality.

Finally, our findings help fill a gap in the literature, which has rarely examined the mediation of ER (for exceptions, see de la Fuente et al., 2024; Xu et al., 2024). Actively Approaching mediated the relation between Extraversion, Agreeableness, Negative Emotionality, and Open-Mindedness, and two positive emotions, pride and relaxation. Refocus on Planning did not mediate any relation, suggesting that planning is beneficial when studying whether plans are implemented (as in the case

Table 3
Selected unstandardized and standardized specific indirect effects between Big Five personality traits and achievement emotions.

Model	Selected specific indirect effect	*b*	β	*SE*	*p*	BCA 95% CI
Positive emotions	Extraversion → Actively Approaching → Enjoyment	0.01	0.02	0.01	.081	[0.00, 0.02]
	Extraversion → Actively Approaching → Pride	**0.01**	**0.02**	**0.01**	**.046**	**[0.01, 0.02]**
	Extraversion → Actively Approaching → Relaxation	**0.01**	**0.02**	**0.01**	**.034**	**[0.01, 0.02]**
	Agreeableness → Actively Approaching → Enjoyment	0.02	0.02	0.01	.066	[0.00, 0.03]
	Agreeableness → Actively Approaching → Pride	**0.02**	**0.02**	**0.01**	**.028**	**[0.01, 0.04]**
	Agreeableness → Actively Approaching → Relaxation	**0.02**	**0.02**	**0.01**	**.029**	**[0.01, 0.04]**
	Conscientiousness → Actively Approaching → Enjoyment	0.01	0.01	0.01	.122	[0.00, 0.01]
	Conscientiousness → Actively Approaching → Pride	0.01	0.01	0.01	.080	[0.00, 0.01]
	Conscientiousness → Actively Approaching → Relaxation	0.01	0.01	0.01	.068	[0.00, 0.01]
	Negative Emotionality → Actively Approaching → Enjoyment	−0.01	−0.02	0.01	.062	[−0.02, 0.00]
	Negative Emotionality → Actively Approaching → Pride	**−0.01**	**−0.03**	**0.01**	**.026**	**[−0.03, −0.01]**
	Negative Emotionality → Actively Approaching → Relaxation	**−0.01**	**−0.03**	**0.01**	**.020**	**[−0.02, −0.01]**
	Negative Emotionality → Catastrophizing → Hope	**0.01**	**0.03**	**0.01**	**.028**	**[0.01, 0.03]**
	Open-Mindedness → Actively Approaching → Enjoyment	0.01	0.01	0.01	.072	[0.00, 0.02]
	Open-Mindedness → Actively Approaching → Pride	**0.01**	**0.02**	**0.01**	**.038**	**[0.01, 0.02]**
	Open-Mindedness → Actively Approaching → Relaxation	**0.01**	**0.02**	**0.01**	**.031**	**[0.01, 0.02]**
Negative emotions	**Extraversion → Withdrawal → Boredom**	**−0.01**	**−0.02**	**0.01**	**.040**	**[−0.02, −0.01]**
	Agreeableness → Withdrawal → Boredom	−0.01	−0.01	0.01	.104	[−0.02, 0.00]
	Negative Emotionality → Withdrawal → Boredom	**0.01**	**0.03**	**0.01**	**.035**	**[0.01, 0.02]**
	Negative Emotionality → Catastrophizing → Anxiety	**0.03**	**0.05**	**0.01**	**<.001**	**[0.01, 0.04]**
	Negative Emotionality → Catastrophizing → Anger	**0.02**	**0.04**	**0.01**	**.013**	**[0.01, 0.03]**
	Negative Emotionality → Catastrophizing → Hopelessness	**0.02**	**0.04**	**0.01**	**.005**	**[0.01, 0.03]**

Note. We reported the specific indirect effects only for cases in which the path analyses revealed a significant path between one of the Big Five traits and one of the emotion regulation strategies, together with a significant path between the latter strategy and one of the achievement emotions. Indirect effects were estimated using nonparametric bootstrapping with 5000 resamples and bias-corrected and accelerated 95% confidence intervals (Hayes, 2018). The examination of the indirect effects, considering the *p*-value and the confidence interval, was analogous, with 14 out of the 23 selected cases indicating mediation (in bold). *SE* = standard error; BCA 95% CI = bias-corrected and accelerated 95% confidence interval.

Table 4
Fit indexes of the constrained or unconstrained models across gender and country, separately for path analyses on positive and negative emotions, and chi-square of the multi-group comparisons.

Model	Multi-group comparison		CFI	TLI	RMSEA	SRMR	χ^2(df)	*p*
Positive emotions	Gender	Constrained model	0.997	0.992	0.016	0.023	67.83(65)	.381
	Country	Constrained model	0.985	0.967	0.033	0.031	83.75(65)	.059
Negative emotions	Gender	Constrained model	0.998	0.960	0.036	0.012	58.48(65)	.703
	Country	Unconstrained model	0.994	0.883	0.061	0.014	101.35(65)	.003

Note. We reported the fit indexes of the constrained model when the multi-group comparison was not significant, and of the unconstrained model when it was significant. CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual; TLI = Tucker-Lewis index.

Table 5
Standardized Coefficients of the Significantly Different Effects Across Country (Italy, United Kingdom) and Chi-Square Comparisons.

Effects	Country	β	*p*	$\Delta\chi^2$	*p*
Extraversion → Actively Approaching	Italy	0.15	<.001	3.92	.049
	United Kingdom	0.20	<.001		
Extraversion → Catastrophizing	Italy	0.01	.830	3.89	.049
	United Kingdom	0.14	.024		
Conscientiousness → Anger	Italy	−0.07	.091	4.32	.038
	United Kingdom	0.08	.156		
Conscientiousness → Shame	Italy	0.04	.322	5.49	.019
	United Kingdom	−0.12	.038		
Negative Emotionality → Shame	Italy	0.13	.008	5.92	.015
	United Kingdom	0.26	<.001		
Negative Emotionality → Hopelessness	Italy	0.30	<.001	11.02	<.001
	United Kingdom	0.40	<.001		

Note. Regarding the multi-group path analysis across countries, we reported the difference between the chi-square ($\Delta\chi^2$) of the constrained model (in which all the relations were constrained to be equal) and the partially constrained model (in which all the relations were constrained to be equal, except the one described in the first column).

of Actively Approaching), not just designed. As for the maladaptive strategies, Withdrawal mediated the relation of Extraversion and Negative Emotionality with boredom, while Catastrophizing mediated the relation of Negative Emotionality with hope, anxiety, anger, and hopelessness. Overall, these findings highlight the differential mediational role of the four strategies, with different applied implications. Moreover, only the mediations involving Negative Emotionality were partial, supporting the pervasive and marked influence of negative mood and lability on AEs through multiple mechanisms.

Concerning aim 2, the multi-group PAs revealed that the relations between the three constructs can be generalized universally to students of different genders, as assumed by the CVT (Pekrun, 2006; Pekrun et al., 2023), for both positive and negative AEs. Considering different cultural contexts, our data supported the universality assumption only partially. The links between ER strategies and AEs were similar in the two countries. Nevertheless, some of the links including the BF traits varied between Italy and the UK, in line with previous meta-analyses documenting that some relations between personality and other constructs also differ across cultures (e.g., Chen et al., 2025). It is worth noting that the relations of Extraversion with Actively Approaching and Catastrophizing were stronger in the UK than in Italy, but this was only slightly under the significance threshold, and emerged only from the PA on negative emotions. More attention could be devoted to the relations of Conscientiousness with anger and shame, and of Negative Emotionality with shame and hopelessness. On the one hand, more conscientious students tended to be less ashamed and more angry in the UK compared

to Italy. Conscientiousness may be associated with a shift away from self-conscious emotions, such as shame, toward more externally oriented responses, such as anger, a pattern that was less evident in Italy. On the other hand, being emotionally unstable and tending to generally feel negative emotions seems to exacerbate the perception of shame and hopelessness, while studying, more for the participants from the UK than Italy. This suggests that, for participants studying in Italy, other contextual variables may moderate this relation. Further research could further explore the plausibility of such an interpretation. On the whole, these differences may reflect cultural differences in emotional intensity, expressiveness, and application of emotion exhibition rules between Northern European and Mediterranean contexts, possibly rooted in environmental differences in emotion development and socialization practices (Bozicevic et al., 2021).

4.1. Practical implications

These findings have the potential to inform professionals – such as educators, professors, or psychologists – in developing effective strategies to promote university students' learning and well-being. The beneficial or detrimental impacts of personality on AEs, directly or through ER, speak in favor of the urgency of monitoring students who are at risk, to develop individualized strategies to protect their vulnerabilities. For example, systematic surveys of university students could be used to identify those who are less extraverted, agreeable, conscientious, and open-minded, and more neurotic, as a first preventive step toward implementing specific early actions to support them. However, BF traits are considered relatively stable (Goldberg, 1993; Soto & John, 2017), and therefore it is hard to directly address them to foster their changes.

Unlike BF traits, ER strategies are malleable and more responsive to actions aimed at modifying them (Berkovich & Eyal, 2021), making this construct an ideal area for professionals to target. In particular, our results extend previous research indicating the need for supporting students' ER, with cascading effects on their well-being, particularly in terms of AEs, as well as learning (Stockinger et al., 2025). On the whole, our findings revealed that actively implementing plans to solve problems was associated with higher positive AEs, while withdrawing from situations and people, and focusing on the extreme negativity of experiences, was related to higher negative emotions. Considering that these three strategies can be implemented along the whole process of emotion origin as conceptualized by Gross's (2015) PMER (i.e., situation selection, situation modification, attentional deployment, cognitive change, and response modulation), our findings suggest that professionals can help students to deal with study-related emotions in every phase. Such actions can include implementing structured interventions, disseminating psychoeducational materials, or even offering informal feedback (e.g., Laure et al., 2024; Raccanello et al., 2020; Wright et al., 2025). At the same time, they could also contribute to alleviating the pervasive mental health challenges currently faced by university students.

Finally, relevant applied implications can be derived from findings about the mediation of ER strategies, especially for cases in which it was total. This happened for Actively Approaching – which mediated the relation of four traits (i.e., Extraversion, Agreeableness, Negative Emotionality, and Open-Mindedness) with pride and relaxation – and Withdrawal – which mediated the relation of Extraversion with boredom. Given that ER strategies are comparatively more malleable than broad personality traits, actions targeting these two strategies may represent a viable pathway to modulate the emotional outcomes associated with dispositional tendencies. In this sense, promoting Actively Approaching and discouraging Withdrawal could either amplify or buffer the influence of personality traits on specific emotional experiences, offering a more flexible leverage point for promoting adaptive emotional functioning.

4.2. Limitations and future directions

This study suffers from some limitations. First, our BF measure did not encompass all facets of each BF trait (Soto & John, 2017); further studies should investigate whether single facets are differentially associated with ER and AEs. Second, we selected four ER strategies; future investigations could examine a larger range from the BERQ and CERQ, such as seeking distraction, ignoring, acceptance, or self-blame. Third, in line with previous research (Raccanello et al., 2022a), we assessed AEs using single items, which limits reliability estimates and may reduce construct validity; nevertheless, this helped to shorten the questionnaire, thereby diminishing the risk of recall biases and participants' fatigue. Fourth, we employed a cross-sectional design and did not investigate the reciprocal relations between constructs; in line with CVT's assumptions about reciprocal causation (Pekrun, 2006; Pekrun et al., 2023), longitudinal studies should examine these relations. Fifth, we only considered students who identified as male or female when assessing the structural invariance; future research should explore whether relations remain stable for non-binary students as well. Sixth, although we involved students from two countries, these were limited to Western cultures; future research should study cross-cultural differences including participants from a variety of countries. Seventh, we used self-report instruments, prone to memory and desirability biases; while further physiological or observational measures are needed to triangulate our findings, self-reports still remain among the key ways to access people's inner world.

5. Conclusions

We advanced knowledge about the mediating role of ER strategies in the relation between BF traits and AEs. At an applied level, such knowledge can support interventions tailored to enhancing the well-being and learning of university students, focusing on their individual differences.

CRediT authorship contribution statement

Daniela Raccanello: Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Giada Vicentini:** Writing – original draft, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Laura J. Nicholson:** Writing – review & editing, Software, Project administration, Methodology, Investigation, Data curation, Conceptualization. **David W. Putwain:** Writing – review & editing. **Roberto Burro:** Writing – review & editing, Visualization, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation.

Declaration of competing interest

We have no conflicts of interest to disclose.

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Data availability

Data will be made available on request.

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