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Context Matters in the Effectiveness of Emotion Regulation Strategies

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In the time before an upcoming exam, anxiety is an omnipresent emotion that students may choose to regulate. To date, emotion regulation strategies have been examined in everyday life, but little is known about how these strategies work in exam-related contexts. Therefore, our aim was to explore the effectiveness of several emotion regulation strategies across two contexts (exam-related vs. non-exam-related anxiety). A total of 68 university students participated in an experience sampling study for 6 days prior to an important exam. Suppression improved mood in exam-related anxiety, while distraction improved mood only in non-exam-related anxiety. Considering these differing effects, it is important to not unilaterally classify emotion regulation strategies into effective versus ineffective but to also consider the context in which the emotion is experienced.

Keywords: *achievement emotions, anxiety, emotion regulation strategies, mood, experience sampling*

Every university student is familiar with the consuming thoughts and feelings that accompany the impending approach of exams. During this time, students might feel anxious because they fear failure. Anxiety that is associated directly with an achievement activity or outcome is referred to as achievement anxiety (Pekrun, 2000, 2006). A specific type of achievement anxiety is exam-related anxiety. This arises due to an upcoming exam and is negative in nature, which could have detrimental consequences for students. Negative emotions in general are associated with short-term outcomes such as being in a bad mood (Gross & Thompson, 2007; Pekrun, 2006). Thus, students might be anxious about an upcoming exam and therefore be in a bad mood while preparing for the exam. There are also long-term outcomes of experiencing negative exam-related emotions, especially anxiety, such as decreased motivation and self-regulated learning (Goetz & Hall, 2013; Pekrun, Goetz, Titz, & Perry, 2002) and the increased use of superficial learning strategies (Schmitz, 2001). A low level of exam-related anxiety might be motivating for students, but overall anxiety has negative consequences. Therefore, it is in students' best interest to regulate their exam-related anxiety. However, how students should regulate their anxiety about exam-related activities and outcomes is an unanswered question. Since learning is an emotionally laden process (Schutz, Hong, Cross, & Osbon, 2006), it is important to explore the effectiveness of emotion regulation strategies in an exam-related context and compare it to effectiveness in unspecific contexts. There has been relatively little research on regulating anxiety in exam-related contexts; thus, it is unclear whether emotion regulation strategies that are effective in some contexts are equally effective in exam-related contexts.

A study by Aldao (2013) suggests that there is a need to explore context within emotion regulation research as different strategies might not be useful in every context. Furthermore, Bonanno and Burton (2013) state in their review on emotion regulation that there is a false assumption of strategies' being adaptive and maladaptive and call it the "fallacy of uniform efficacy." They define this as the tendency to consistently label particular emotion regulation strategies as effective or ineffective. They describe it as the failure to account for the associated outcomes across situations. Although in theory the effectiveness of coping was described as a match of strategy to situation (Aldao, 2013; Folkman, 1984; Gross, 1998; Sheppes et al., 2014), researchers still tend to categorize strategies as adaptive or maladaptive. Therefore, Bonanno and Burton state the importance of considering the situational context in which individuals respond to life stressors when examining the effectiveness of emotion regulation strategies.

Mood

Past research has examined the effectiveness of emotion regulation strategies by examining their effect on mood (Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Heiy & Cheavens, 2014). However, unlike this previous research we are not distinguishing positive from negative mood (cf. Brans et al., 2013) or referring to general mood (Heiy & Cheavens, 2014); rather we would like to identify the improvement in valence and arousal of mood as Wilhelm and Schoebi (2007) recommend for within-person variation. A mood is a prolonged physiological feeling of low intensity, does not have an object focus, and includes both valence (pleasant/unpleasant) and arousal (activating/deactivating) dimensions (Russell, 2003). Wilhelm and Schoebi evaluated a three-dimensional structure of mood, especially for within-person variations, that included valence, arousal, and calmness. All three dimensions were sensitive enough to capture fluctuations in mood states. Valence and arousal are compatible with the theoretical dimensions found by Russell (2003). Some researchers would agree that mood should be differentiated from emotions because emotions are short-term reactions to a specific stimulus and are more intense whereas a mood may last for hours, is less intense, and has no specific object focus. But as Pekrun (2006) contemplates, "How should affective states be categorized that are intense and short without having a clear focus, or intense and focused, but long-lasting?" (p. 316). Pekrun suggests mood represents the same theoretical construct as emotion but does not fluctuate as much as emotions. Thus, they are on the same continuum. Intensity, duration, and object focus therefore do not represent dichotomous characteristics; they rather represent a dimension on which we can describe mood and emotions. So since emotions are fleeting and researchers have agreed that mood is a very convenient outcome variable (Brans et al., 2013; Heiy & Cheavens, 2014; Pekrun, 2006; Wilhelm & Schoebi, 2007), mood might be the method of choice for identifying the effectiveness of strategies in exam-related situations because it is linked to exam-related thoughts in the same manner as emotions. Research about how emotion regulation strategies affect mood in exam-related situations is still lacking. Therefore, in our study we examined the short-term effectiveness of the emotion regulation strategies reappraisal, suppression, expression, and distraction on mood when regulating exam-related and non-exam-related anxiety.

Anxiety Situated in Contexts

Emotions in general occur when we are in a situation: we attend to this situation and appraise it (for a description of the modal model of emotion see Gross, 2015). One type of situation that is often regarded as highly relevant for the generation of anxiety (see Pekrun et al., 2002) is preparing for an upcoming exam. One might appraise this situation, thinking, "I will fail this exam because I do not fully understand the learning material," and then experience anxiety (Gross, 2015). This anxiety is considered an achievement emotion, more specifically an exam-related achievement emotion. As previously mentioned, achievement emotions are defined as emotions that occur during an achievement-related activity or are about an achievement outcome (Pekrun, 2006). Exam-related emotions are achievement emotions that are directly linked to achievement-related exam outcomes. According to Pekrun's (2006) control-value theory, the appraisals of control and value in achievement settings are essential for experiencing achievement emotions. The appraisal constellations of anxiety include high negative personal value of the prospective outcome (e.g., failure) and a medium level of control. Further, anxiety is related to potential failure and is the most often experienced emotion when one is confronted with exams (Schmidt, Tinti, Levine, & Testa, 2010). According to Pekrun (2006), we assume that exam-related anxiety might differ from anxiety experienced in other situations, especially in the type of reactions it elicits.

Emotion Regulation

Emotion regulation is defined as the redirection of emotions and encompasses strategies people use to decrease, increase, or maintain their emotions (Gross, 2007). People use many strategies to change the intensity of their experienced emotions and as a consequence improve their affect or mood (Brans et al., 2013; Heiy & Cheavens, 2014; Parkinson & Totterdell, 1999). Numerous researchers have attempted to classify these strategies (Gross, 1998; Koole, 2009; Parkinson & Totterdell, 1999). Parkinson and Totterdell (1999) presented a two-dimensional matrix that distinguishes between cognitive and behavioral strategies as well as engagement and disengagement strategies. This model overlaps with the process model of emotion regulation developed by Gross (1998, 2015), who classifies emotion regulation strategies in a temporal order based on when they occur in the emotion-generation process. Furthermore, it also overlaps with Koole's (2009) classification model, which classifies the strategies according to functions and targets. Based on these models of emotion regulation strategies (Gross, 2015; Koole, 2009; Parkinson & Totterdell, 1999), we decided to examine the effectiveness of four strategies: reappraisal, suppression, expression, and distraction.

Reappraisal alters the meaning of an emotional situation to reduce its emotional impact (Gross, 2015): for example, thinking about an upcoming exam as a challenge rather than a threat. Suppression refers to the inhibition of one's emotionally expressive behavior (e.g., trying not to show anxiety) and is used when the emotion has already gathered force (Gross, 2015). Expression, on the other hand, is used to vent one's emotions (Carver, Scheier, & Weintraub, 1989), for instance, to release oneself from anger. Distraction redirects

or shifts one's attention away from a certain situation (Gross, 2007), for example, watching TV to avoid the emotional situation. Therefore distraction doesn't need an evaluation process and just replaces existing information with neutral information (Sheppes & Gross, 2011).

Effectiveness of Emotion Regulation Strategies

Reappraisal. Reappraisal is typically associated with beneficial outcomes such as improved mood (Brans et al., 2013; Heiy & Cheavens, 2014). Past research has found that in comparison to suppression, reappraisal has a positive effect on a wide range of domains, such as increased interpersonal functioning and well-being (Gross & John, 2003); increased experiences of positive and decreased experiences of negative emotions (Gross & John, 2003); and decreased psychopathology (Aldao, Nolen-Hoeksema, & Schweizer, 2010).

Using reappraisal to regulate emotions while learning has been found to lead to better comprehension scores in comparison to not regulating one's negative emotions (Strain & D'Mello, 2011). Reappraising anxiety has also been found to lead to improved math performance (Brooks, 2014) and GRE performance 3 months after the reappraisal induction (Jamieson, Mendes, Blackstock, & Schmader, 2010) in comparison to not reappraising the anxiety. In addition reappraisal showed a positive relation to positive experienced emotions while preparing for high school exit exams (Levine, Schmidt, Kang, & Tinti, 2012). Thus, there is evidence that in exam-related situations reappraisal can be helpful in various ways, but there is also recent evidence that reappraisal is more likely than suppression to be related to unpleasant achievement emotions. Burić, Sorić, and Penezić (2016) conducted a study wherein students had to complete a self-report questionnaire about eight emotion regulation strategies and achievement emotions from the Academic Emotion Questionnaire (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) after a scheduled course. Whereas reappraisal is typically thought of as a healthy emotion regulation strategy (Gross & John, 2003), Burić et al. found reappraisal to be related to increased experiences of anxiety compared to suppression. While findings on reappraisal in unspecified contexts show promising results, in exam-related situations there is a hint that reappraisal might not always be as helpful as it is in other situations. Since this finding has been reported only by Burić et al. (2016), further research in exam-related contexts is needed.

Suppression. Suppression often has been contrasted with reappraisal and has been found to be negatively related to many outcomes; for example, it decreases positive affect (Brans et al., 2013) and leads to lower social satisfaction and social support (Srivastava, Tamir, McGonigal, John, & Gross, 2009). There is also evidence that suppression is used more by persons high in social anxiety (O'Toole, Jensen, Fentz, Zachariae, & Hougaard, 2014). Surprisingly, Catterson, Eldesouky, and John (2017) showed that suppression has no degrading effect on well-being when an individual is high in social hierarchy and defined the strategy as a "handbrake" to protect oneself from negative outcomes when no other strategies worked.

In exam-related situations, however, Burić et al. (2016) found that suppression is associated with not only negative but also positive emotions. Suppression showed a positive correlation not only with negative but also with positive academic emotions like enjoyment and pride. From these results Burić et al. concluded that suppression might be an essential strategy in academic settings and is perhaps even useful. Although there is not much empirical evidence supporting this conclusion, Burić et al. could show that suppression is positively correlated with positive emotions, which indicates that suppression might be a useful strategy in some contexts.

Expression. Past research revealed that in naturally occurring situations (no distinction between exam- and non-exam-related situations), the expression of positive emotions showed a negative effect on global mood (Heiy & Cheavens, 2014); furthermore, expressing emotions has been found to be associated with lower levels of emotional control and confidence and higher levels of pessimism in athletes (Nicholls, Polman, Levy, & Backhouse, 2008). Venting one's anger has been found to be related to an increase in aggressive behavior and to not lead to a positive mood (Bushman, 2002), which contradicts the catharsis theory that venting one's anger leads to an improvement in one's feelings and purges anger and aggression. Apart from the evidence that expression does not in general lead to improved mood, there is no known evidence about the effectiveness of expression specifically for exam-related anxiety.

Distraction. Distraction is known to be associated with positive affect in daily life (Brans et al., 2013) and leads to low emotional responses to negative emotional material (Bennett, Phelps, Brain, Hood, & Gray, 2007). Furthermore, distracting oneself from a situation by exercising, for example, has been found to improve mood in everyday life (Heiy & Cheavens, 2014). Within exam-related situations, on the contrary, distraction has been found to be associated with less dedication to studying during an exam-preparation phase (Levine et al., 2012). Although distraction seems to be a beneficial strategy in non-exam-related situations, there is rare evidence that distraction might be harmful in the preparatory phase of exams.

Aims of the Present Study

Past research (Brans et al., 2013; Genet & Siemer, 2012; Heiy & Cheavens, 2014) has used the link between strategies and mood to evaluate the short-term effectiveness of emotion regulation strategies. To date, there is no consensus

about the different short-term effects of emotion regulation strategies on mood when regulating exam-related versus non-exam-related anxiety. Besides the negative effects of suppression and positive effects of reappraisal on mood in several studies (Brans et al., 2013), there is recent evidence that suppression not only has a positive relation to negative learning-related emotions but also a positive relation to positive learning-related emotions (Burić et al., 2016) and at least no negative relation to well-being (Burić et al., 2016; Catterson et al., 2017). Burić et al. (2016) conclude that suppression, for example, might not only be hindering, and therefore, they hint at emotion regulation strategies' being context dependent. Therefore, in our study we try to empirically confirm this conclusion by exploring how students regulate their exam-related versus non-exam-related anxiety and the ensuing improvement in mood.

Our aim was to explore the short-term effectiveness of these emotion regulation strategies. Specifically, we explored whether emotion regulation strategies improved the two dimensions of mood, namely, valence and arousal. Again, we further explored whether context (exam-related vs. non-exam-related anxiety) moderates this relationship, which according to Bonanno and Burton (2013) is essential when examining the effectiveness of emotion regulation strategies. Following the results of Brans et al. (2013), we expected that reappraisal and distraction would improve the valence and arousal dimensions of mood, while suppression would worsen them. For expression, we did not have any directed expectations. When adding context as a moderator, we expected different results for exam-related anxiety compared to non-exam-related anxiety. According to the findings of Burić et al. (2016), who, based on their results, concluded that suppression might be an inevitable form of emotion regulation in learning-related contexts, we believe that there might be a difference in the effectiveness of suppression on mood based on whether or not anxiety is exam related.

To be able to meaningfully assess exam-related anxiety, the study was conducted during an exam phase. Furthermore, to avoid retrospective bias and improve accuracy, the experience sampling method (ESM) was applied (Ebner-Priemer & Trull, 2009); this represents a convenient method for this type of research (Csikszentmihalyi & Larson, 1987, 2014; Zirkel, Garcia, & Murphy, 2015). Several studies have explored emotion regulation strategies using ESM (Brans et al., 2013; Catterson et al., 2017; Heiy & Cheavens, 2014), but no studies known to us have investigated emotion regulation strategies specifically in situations of exam-related versus non-exam-related anxiety.

Method

Participants

In total, 68 first-year psychology and education students at a German university participated in this study (90% female, M_{age} = 20.6 years, SD_{age} = 4.2 years). Students were recruited through psychology tutorials for first-semester students and through a lecture for freshmen majoring in education. All students were enrolled in either a psychology or an education course and received course credit or monetary compensation for their participation.

Procedure

One week before an important exam, students attended an initial lab session to learn about the study, receive instructions about how to use the electronic device programmed with the experience sampling study, answer paper-pencil questionnaires for demographic information, and give informed consent. The study began the day after the lab session and ended the night before the important exam. After completing their exams, students returned the study device and received compensation for their participation.

Daily Self-Reports

The electronic devices were programmed with MovisensXS (MovisensXS, n.d.), a research tool for ESM, which supports Android smartphones (in this study Motorola Moto E, first generation). For 6 days before an important exam, students were randomly signaled five times per day by an alarm to fill out a questionnaire (signal-contingent interval sampling). Students were signaled between 9:00 a.m. and 8:30 p.m. during weekdays and 10:00 a.m. and 9:30 p.m. on weekends to answer a short questionnaire on the electronic device. The alarms followed a random interval sampling schema, where participants were buzzed at semirandom time intervals, meaning that during the day they received five alarms that were a minimum of 1 hour and a maximum of 4 hours apart. The participants were requested to immediately fill out the questionnaire and had 4 min until the questionnaire was coded as missing. The questions were always presented in the same order (the items are listed in the Measures section in the order they were presented). There were 1,846 measurement points (Level 1) across 68 students (Level 2). The average response rate per person was 27 out of 30 questionnaires, which resulted in a 92.5% compliance rate, meaning that every person missed approximately three questionnaires throughout the week. The average response duration was about 2 min per alarm.

Measures

Mood. We began by asking students questions about their current mood. Students responded to bipolar items that assessed the valence and arousal dimensions of mood (Wilhelm & Schoebi, 2007). These scales were constructed to measure mood in real-life situations via ESM. To assess valence, we had students respond to the five-point bipolar items, "At the moment I feel" *unwell* to *well* and *discontent*

to *content.* To assess arousal, we had participants respond to the five-point bipolar items, "At the moment I feel" *tired* to *awake* and *without energy* to *full of energy.* Wilhelm and Schoebi (2007) illustrated that the scales showed good reliability at both the person level (both reliabilities greater than .90) and the observation level (reliabilities were .66 and .77), which indicates that these two item scales represent a good instrument for measuring mood in experience sampling studies. They also found that two-thirds of the total latent variation was due to fluctuation over time; thus, the scales are an adequately sensitive measure of mood and therefore also demonstrate their validity.

Context. To differentiate exam-related from non-exam-related emotions, we asked students the following item: "In the past hour I thought about the exam." This dummy item (0 = *non-exam related*, 1 = *exam related*) serves as the moderator variable in our analysis and is referred to as "context" throughout the article.

Exam-related and non-exam-related anxiety. To identify the most intensely experienced exam-related and non-exam-related emotion, we asked students to specify which emotion they had most intensely experienced in the past hour. Students could choose from the following emotions: anxiety, anger, frustration, boredom, joy, hope, pride, and relief. Only anxiety was considered in this article, as this was the focus of this article and the most frequently experienced negative emotion. When the context item was answered with "yes," the participant was specifically asked about the most intensely experienced emotion while thinking about the exam, and if he or she answered "no," the participant was asked about the most intensely experienced emotion in general.

Emotion-regulation strategies. At the end of each questionnaire, students were asked to rate how they regulated their most intensely experienced emotion. They rated the extent to which they had used four emotion regulation strategies (suppression, reappraisal, distraction, and expression) in the past hour to regulate their emotions. Each strategy was measured by a single item on a five-point Likert-type scale ranging from 0 (*disagree*) to 4 (*agree*). The following items were used to measure the emotion regulation strategies: "I thought about the situation in a different way" (reappraisal), "I suppressed my [emotion]" (suppression), "I showed my [emotion]" (expression), and "I engaged in activities to distract myself" (distraction).

Data Analysis

We used the software HLM 7 (HLM—Hierarchical Linear and Nonlinear Modeling, n.d.) for hierarchical linear modeling to account for our two-level data structure. The measurements at random points (n_{Level1} = 1,846) were nested within persons (n_{Level2} = 68). Because the present study focused on the experience and regulation of anxiety, the main analyses (Models 0–3) refers to only the occasions when anxiety was selected as the most intensely experienced emotion in the past hour. Anxiety was the most frequently experienced negative emotion (n_{Level1} = 294), which represents 16% of all possible responses. The response frequency for all other emotions was between n_{Level1} = 48 (for anger, 3%) and n_{Level1} = 412 (for hope, 22%). We ran null models and random-intercept models with predictors on Level 1. The Level 1 parameters were allowed to vary randomly across participants at Level 2. Thus, the outcome at Level 1, representing a person's mood score, was modeled as a function of a random intercept and four random slopes (Model 2), which represent the relationship between emotion regulation strategies and mood. In addition, for Model 3, we included five other random slopes, representing the influence of context on mood and the interaction of emotion regulation strategies and context on mood. Predictors were not centered in Models 2 and 3, because of meaningful zero points, which assist in interpreting the results (Dalal & Zickar, 2011). Robust standard errors are reported for all models. Restricted maximum likelihood estimation was used.

First to examine means, standard deviations, and intraclass correlations of all study variables, we constructed null models (or intercept-only models) of the two dichotomous variables—context and anxiety—and the continuous variables—mood (valence and arousal) and emotion regulation strategies (reappraisal, suppression, expression, distraction) (see Table 1). We examined this both for the whole sample and for the reduced sample, when anxiety was the most intensely experienced emotion. The following model is exemplary for all study variables.

Model 0: Null model of valence

$$\text{Valence}_{\text{ti}} = \beta_{00} + r_{0i} + e_{ti}.$$

For correlations between the study variables we conducted models, where we first *z*-standardized all variables and then added them separately as predictors to the model:

Model 1:

$$\text{Valence}_{\text{ti}}\left(\text{z-standardized}\right) = \beta_{00} + \beta_{10} * \text{Arousal}_{\text{ti}}\left(\text{z-standardized}\right) + r_{0i} + e_{ti}.$$

For our main aim, we examined whether the valence and arousal dimensions of mood are predicted by emotion regulation strategies. We included reappraisal, suppression, distraction, and expression in the model when students rated anxiety as their most experienced emotion. The following models are exemplary for both mood dimensions (valence and arousal):

Model 2: Two-level regression model of valence predicted by the four emotion regulation strategies

TABLE 1
Descriptive statistics of all study variables (Models 0 and 1)

	Variable	*M*	*SD*	ICC	1	2	3	4	5	6	7	n^1	n^2
Whole Sample													
1	Anx[a]	0.16	.14	.15								1,845	68
2	Cont[a]	0.60	.17	.12								1,846	68
3	Val	2.43	.55	.29								1,846	68
4	Arou	2.09	.46	.20			.35***					1,846	68
5	Reap	0.92	.55	.28			−.07*	.00				1,845	68
6	Supr	0.89	.50	.17			−.20***	−.05*	.20***			1,845	68
7	Exp	2.07	.67	.26			.12***	.10***	−.07*	−.25***		1,843	68
8	Dist	1.42	.67	.18			.11**	.02	.12**	.16***	.11***	1,845	68
Sample Experiencing Anxiety													
2	Cont[a]	0.73	.17	.15								294	55
3	Val	1.90	.50	.26								294	55
4	Arou	1.85	.43	.17			.28***					294	55
5	Reap	1.23	.67	.37			.01	.03				294	55
6	Supr	2.04	.66	.29			.19***	.10	.15			294	55
7	Expr	1.53	.74	.36			−.22***	−.03	−.03	−.18		294	55
8	Dist	1.73	.73	.23			.15**	−.10	.20**	.20*	.07	294	55

Note: Correlations are at the state level. ICC = between-persons correlation; n^1 = sample size Level 1; n^2 = sample size Level 2; Anx = anxiety; Cont = Context; Val = Valence; Arou = Arousal; Reap = reappraisal; Supr = suppression; Expr = expression; Dist = distraction.
[a]Dichotomous variables.
*$p < .05$. **$p < .01$. ***$p < .001$.

$$\begin{aligned}\text{Valence}_{ti} = {} & \beta_{00} + \beta_{10} * \text{reappraisal}_{ti} + \beta_{20} * \text{suppression}_{ti} \\ & + \beta_{30} * \text{distraction}_{ti} + \beta_{40} * \text{expression}_{ti} + r_{0i} \\ & + r_{1i} * \textit{reappraisal}_{ti} + r_{2i} * \textit{suppression}_{ti} \\ & + r_{3i} * \textit{distraction}_{ti} + r_{4i} * \textit{expression}_{ti} + e_{ti}.\end{aligned}$$

Next, we examined whether the context in which anxiety was experienced and regulated influenced the two mood dimensions by including context and the interaction term (context multiplied by emotion regulation strategy). This model included the four emotion regulation strategies, context, and the four interaction terms (see Table 2).

Model 3: Two-level regression model of valence predicted by the four emotion regulation strategies and moderated by context

$$\begin{aligned}\text{Valence}_{ti} = {} & \beta_{00} + \beta_{10} * \text{reappraisal}_{ti} + \beta_{20} * \text{suppression}_{ti} \\ & + \beta_{30} * \text{distraction}_{ti} + \beta_{40} * \text{expression}_{ti} + \beta_{50} * \text{context}_{ti} \\ & + \beta_{60} * \text{context*reappraisal}_{ti} + \beta_{70} * \text{context*suppression}_{ti} \\ & + \beta_{80} * \text{context*distraction}_{ti} + \beta_{90} * \text{context*expression}_{ti} \\ & + r_{0i} + r_{1i} * \textit{reappraisal}_{ti} + r_{2i} * \textit{suppression}_{ti} + r_{3i} * \textit{distraction}_{ti} \\ & + r_{4i} * \textit{expression}_{ti} + r_{5i} * \textit{context}_{ti} + r_{6i} * \textit{reappraisal} * \textit{context}_{ti} \\ & + r_{7i} * \textit{suppression} * \textit{context}_{ti} + r_{8i} * \textit{distraction} * \textit{context}_{ti} \\ & + r_{9i} * \textit{expression} * \textit{context}_{ti} + e_{ti}).\end{aligned}$$

We also conducted a simple slopes test (Robinson, Tomek, & Schumacker, 2013) to examine the strength of the significant relationships between the regulation strategies and mood dimensions within the context-dependent group (non-exam-related anxiety vs. exam-related anxiety). The estimates are presented in Table 3.

Results

Descriptive Statistics

Table 1 shows means, variances, correlations, and percentages of between-persons correlations[1] of all study variables for both the whole sample and the reduced sample when anxiety was the most intensely experienced emotion. The mean scores of the mood measures were $M_{\text{Valence}} = 2.43$ and $M_{\text{Arousal}} = 2.09$ for the whole sample ($n_{\text{Level1}} = 1{,}846$, $n_{\text{Level2}} = 68$). For the sample experiencing anxiety ($n_{\text{Level1}} = 294$, $n_{\text{Level2}} = 55$), the mean scores were $M_{\text{Valence}} = 1.90$ and $M_{\text{Arousal}} = 1.85$, which shows that the mood average of both scales is lower when experiencing anxiety. Within-person correlations of the two items of each mood dimension demonstrated internal consistency (reliability of valence was .67 and reliability of arousal was .66).

Students answered the context item "In the past hour I thought about the exam" 60% of the time with "yes" and

TABLE 2
Predicting mood from emotion regulation strategies (Model 2) moderated by context (Model 3)

	Valence						Arousal					
	Model 2			Model 3			Model 2			Model 3		
	B	σ^2	*p*	*B*	σ^2	*p*	*B*	σ^2	*p*	*B*	σ^2	*p*
Level 1 (fixed effects)												
Intercept	1.88	1.306	<.001	2.04	2.407	<.001	1.80	2.261	<.001	1.72	3.642	<.001
Context				−0.27	19.941	.305				0.04	31.946	.899
Supp	0.10	0.518	.025	−0.07	0.858	.190	0.09	0.934	.124	−0.01	3.203	.957
Reap	−0.07	0.914	.249	−0.10	1.099	.096	0.04	0.934	.455	0.12	1.931	.138
Expr	−0.17	0.592	<.001	−0.21	1.606	.007	−0.02	0.798	.747	0.10	2.075	.224
Dist	0.09	0.414	.018	0.22	0.929	<.001	−0.09	0.737	.090	−0.09	1.527	.203
Supp × Context				0.24	1.822	.004				0.13	3.726	.243
Reap × Context				0.06	3.042	.543				−0.11	2.893	.280
Expr × Context				0.08	2.737	.426				−0.13	2.792	.174
Dist × Context				−0.18	1.435	.013				−0.01	2.086	.943
Level 2 (random effects)												
Intercept		0.199	.247		0.222	>.500		0.622	.391		0.055	>.500
Context					0.058	>.500					0.413	>.500
Supp		0.004	.368		0.000	>.500		0.028	.375		0.134	>.500
Reap		0.050	.317		0.036	>.500		0.044	.291		0.014	>.500
Expr		0.013	>.500		0.035	>.500		0.015	.310		0.009	>.500
Dist		0.018	>.500		0.045	>.500		0.047	.025		0.037	>.500
Supp × Context					0.015	>.500					0.099	>.500
Reap × Context					0.167	>.500					0.062	>.500
Expr × Context					0.073	>.500					0.040	>.500
Dist × Context					0.070	>.500					0.066	>.500

Note: Supp = suppression; Reap = reappraisal; Expr = expression; Dist = distraction.

therefore had exam-related emotions in 60% of measurement points. Throughout the week, students rated anxiety as their most intense negative emotion 294 out of 1,845 times (determined by the response to the item, "My most intense experienced emotion was anxiety"). Out of these 294 instances, 216 times were in relation to the upcoming exam, and 87 times were in relation to nonexam situations. So in 16% of all given alarms, students' most intense experienced emotion was anxiety. The absolute frequency of exam-related anxiety as the most intensely experienced emotion increased as the exam drew nearer (see Figure 1). Compared to 6 days before the exam, when 22 instances of anxiety were rated as exam related, on the day before the exam, 74 instances of anxiety were rated as exam related.

For the regulation strategies, expression was on average the most commonly selected strategy (M = 2.07), and suppression was on average the least commonly selected strategy (M = 0.89) for the whole sample (n_{Level1} = 1,845) regardless of the context. When considering only the sample experiencing anxiety (n_{Level1} = 294), suppression was on average the most commonly selected strategy (M = 2.04), and reappraisal was on average the least commonly selected strategy (M = 1.23) regardless of the context.

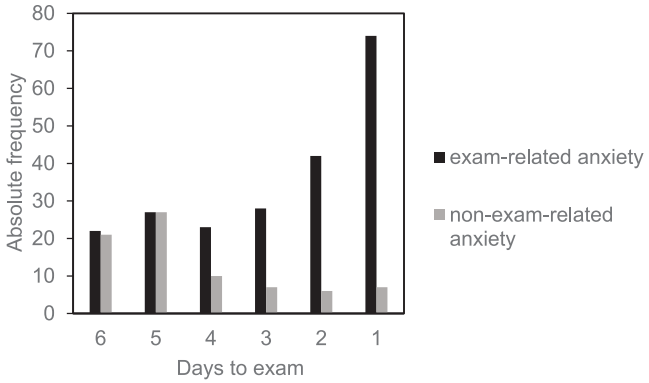

FIGURE 1. *The absolute frequency of anxiety (day level) as the most intense experienced negative emotion in exam-related and non-exam-related contexts as the exam approached.*

Predicting Mood From Emotion Regulation Strategies

Results of Model 2 (see Table 2) showed that using reappraisal to regulate anxiety did not influence any of the measured dimensions of mood. On the other hand, suppression and distraction improved valence, while expression degraded

TABLE 3
Simple slopes model of both contexts

	Valence	Arousal
	B	*B*
Non-exam-related anxiety (n = 78)		
Intercept	1.97***	1.69***
Supp	−0.10	0.06
Reap	−0.14	0.10
Expr	−0.16	0.11
Dist	0.26***	−0.07
Exam-related anxiety (n = 216)		
Intercept	1.74***	1.79***
Supp	0.16**	0.12*
Reap	−0.01	−0.002
Expr	−0.01*	−0.04
Dist	0.04	−0.11
Simple slopes difference		
Supp	0.23***	0.06
Reap	0.13	−0.102*
Expr	0.15*	−0.15*
Dist	−0.22***	−0.04

Note: Supp = suppression; Reap = reappraisal; Expr = expression; Dist = distraction.
*p < .05. **p < .01. ***p < .001.

valence. Effects on arousal were not significant. Other than distraction's positive effect on arousal (p = .025), there were no other significant random effects.

For Model 3 (see Table 2 and Figure 2), we found a significant interaction between context and the effects of some of the emotion regulation strategies on mood when students were experiencing anxiety. We found that context significantly moderated the effect of suppression on valence in that suppressing exam-related anxiety was related to improved valence whereas the effect of suppressing non-exam-related anxiety vanished. The effect size (Cohen's d) of the interaction effect was small to medium, d = .36. In addition, the simple slopes test (Robinson et al., 2013) supported the statistically significant difference between these slopes (t = 3.726, p < .001; see Table 3). We also found that context significantly moderated the effect of distraction on valence in that distracting oneself from exam-related anxiety was related to impairing valence more so than distracting oneself from non-exam-related anxiety. The effect size of the interaction effect was small to medium, d = .43. The simple slopes test revealed a significant difference between these slopes here as well (t = −4.654, p < .001; see Table 3). While there was no interaction effect for expression in the regression model, a simple slope test did show a significant difference between the slopes of the two context groups (t = 2.333, p = .020). The slope of expression within exam-related anxiety was very small but significantly negative, which shows

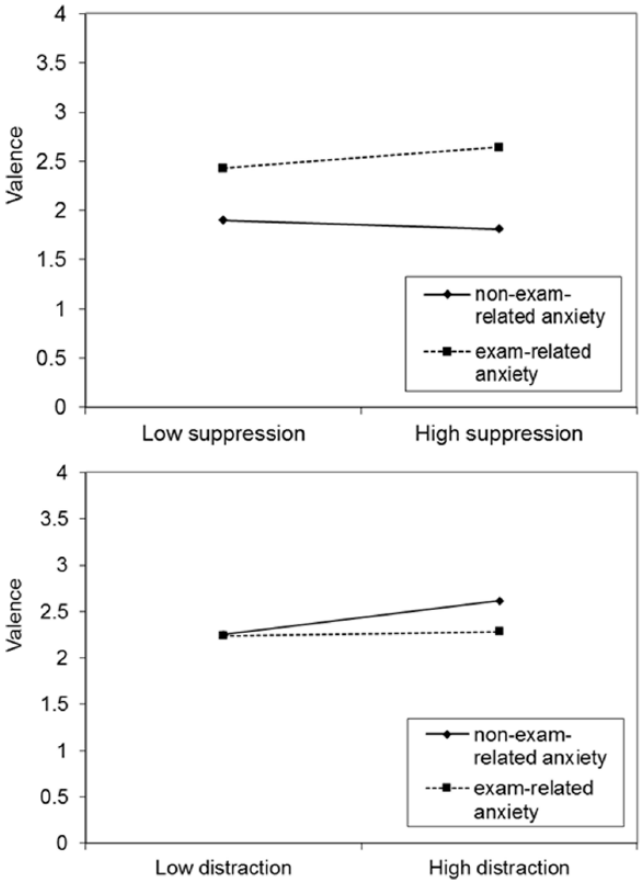

FIGURE 2. *Display of context moderating the effects of the emotion regulation strategies suppression (above) and distraction (below) on the mood dimension valence. (Effect sizes are small to medium: $d_{suppression \times context}$ = .36; $d_{distraction \times context}$ = .43.)*

that expression impairs valence in exam-related contexts.[2] The use of suppression, distraction, and expression when one is experiencing anxiety shows context effects or a significant simple slope test, respectively, in that suppression improves mood in exam-related contexts whereas distraction improves mood in non-exam-related contexts and expression hinders mood in exam-related contexts. The four emotion regulation strategies did not significantly influence the mood dimension arousal, neither when considering the strategies exclusively nor when considering the context effect. Again there were no random slope effects in the valence and arousal models, which shows that there were no differences in the individual's regulation behavior.

Discussion

The aim of this study was to investigate students' emotion regulation strategies in real life 1 week prior to an important exam. The naturalistic assessment was meant to "catch" students' experiences of exam-related versus non-exam-related anxiety and how they regulated this anxiety through emotion

regulation strategies to improve their moods. Hence, this study was the first to investigate how students regulate exam-related versus non-exam-related anxiety. A 6-day ESM design was used to assess students' experiences of anxiety and their corresponding emotion regulation strategies when either exam-related or non-exam-related anxiety was experienced. In the following, we first discuss the effects of regulating anxiety independent of the context (results of Model 2) and then discuss the results of regulating anxiety about an upcoming exam versus regulating anxiety unrelated to the exam (results of Model 3).

Effectiveness of Emotion Regulation Strategies

Context-independent effects. Our aim was to explore whether emotion regulation strategies influence the valence and arousal dimensions of mood. Regardless of the context, we expected reappraisal and distraction to improve mood, while suppression would impair mood. However, our results did not show these expected effects. Surprisingly, based on previous findings, reappraisal was not significantly related to either mood dimension. In the current study, reappraisal had the lowest mean of all emotion regulation strategies, which shows that it was used rarely by students. Contrary to previous findings, we found that suppression improved mood. In this special week of preparing for an exam, it might have been easier to use quickly working emotion regulation strategies such as suppression rather than more time-consuming strategies such as reappraisal. The positive effect of suppression on mood among the whole sample can be explained by the large number (60% of all examined situations; 73% when anxiety was experienced) of students who experienced emotions due to the upcoming exam. Expression and distraction showed results in line with previous findings, such that expression impaired mood (Bushman, 2002) and distraction improved mood (Brans et al., 2013; Heiy & Cheavens, 2014).

Context-dependent effects. With respect to context, results showed diverging effects of suppression and distraction depending on whether exam-related or non-exam-related anxiety was experienced. When one is experiencing exam-related anxiety, suppression seems to be an effective way to improve mood whereas distraction seems ineffective. More precisely, suppressing exam-related anxiety was associated with an improvement in the valence dimension of mood, but this effect was absent when suppressing non-exam-related anxiety. On the other hand, using distraction for exam-related anxiety, according to the simple slopes test, was not related to a change in the valence dimension of mood, but using distraction for non-exam-related anxiety was related to an increase in the valence dimension of mood.

As Burić et al. (2016) suggested, suppression might be an inevitable emotion regulation strategy in the achievement context. In our study, suppressing anxiety seems to be an effective way to improve one's mood when experiencing exam-related anxiety; reappraisal, on the other hand, did not alter mood regardless of the context in which anxiety was experienced. Distraction on the other hand did not show any effect on mood within exam-related anxiety. Thus, when experiencing exam-related anxiety, distraction seems to not be a good emotion regulation strategy choice. These effects underscore previous work on the importance of considering different contexts (Aldao, 2013; Aldao, Sheppes, & Gross, 2015). It extends and supports previous findings on the effect of suppression on well-being, which was nonnegative (Catterson et al., 2017), and the positive association of suppression and enjoyment and pride in achievement contexts (Burić et al., 2016). Furthermore, it underlines our assumption that it is wise to differentiate between exam-related and non-exam-related anxiety in emotion regulation research.

According to Gross (2001), emotion regulation strategies used late in the emotion-generative process are seen as less effective than early adjustments. He concluded that suppression is an ineffective strategy given that suppression is a response-focused strategy. In our study, this is not true for exam-related anxiety. Although suppression is a cognitive strategy and seems to "steal" cognitive resources, for students experiencing exam-related anxiety, according to our findings, it plays a helpful role in terms of improving mood. A possible explanation of the positive effect of suppression on mood might be that it is a strategy that can be quickly applied and provides short-term relief of negative mood, which might allow the individual to better control the situation and finish the current task.

For distraction, similar to recent findings (Strauss, Ossenfort, & Whearty, 2016), we found an improvement in mood with non-exam-related anxiety, but for exam-related anxiety, we did not find any change in mood ratings. Distraction ("I engaged in activities to distract myself") might have led students to spend less time studying, which could have been responsible for the missing positive effect on their current mood because of a bad conscience.

How Do Students Regulate Their Anxiety?

Based on our results, we can say how students regulate their anxiety in different contexts, but we cannot recommend an emotion regulation strategy that is effective in terms of improving mood across the board. We showed that the ability of emotion regulation strategies to improve mood at times depends on the specific context, which means there is not one strategy that fits all situations or emotions. It is far more complex. Our work supported recent evidence for beneficial or at least not dysfunctional effects of suppression (Burić et al., 2016; Catterson et al., 2017), which has formerly been considered a maladaptive strategy. Specifically, students' use of suppression led to an improvement in mood

in our study. Thus, we can conclude that suppression might be beneficial for mood in certain situations like experiencing exam-related anxiety, but we cannot say in general how students should regulate their emotions. The question is, which aspects are useful for beneficial emotion regulation in terms of mood? Nevertheless, we need to distance ourselves from classifying strategies in either effective or noneffective or adaptive and maladaptive categories and begin examining the situational conditions that lead to a strategy's being effective. Our findings hint that in specific circumstances, such as when experiencing exam-related anxiety, suppression might even be beneficial for improving one's mood.

Limitations

Before evaluating the implications of our findings, we need to consider the limitations. First, even though there are many positive aspects of ESM, it can be very demanding because it requires paying constant attention to the device. Especially in our study, where students received five randomized alarms per day for 6 consecutive days, this could have been very stressful for the participants. However, the multiple questionnaires per day might have helped students to reflect on their emotions much more and keep more focused on the task. Second, students might have automatically regulated their emotions or may not have had access to their whole repertoire of strategies. This study demanded a high level of self-reflection. Because the participants answered the same questionnaire 30 times during the week, they might have improved in their self-reflection over time. Third, our study consisted of around 90% females, which could have biased the results. Brans et al. (2013), for example, showed that the reflection strategy increased positive affect only in women. Fourth, we examined only four emotion regulation strategies, but as Heiy and Cheavens (2014) showed, there are a lot more strategies that could be examined. Furthermore, we concentrated on students' experiences of anxiety, but students experience numerous other emotions while preparing for an exam. This limitation is closely linked to the fifth limitation: while an important strength of ESM is the real-life assessment of constructs, this also leads to a level of uncontrollability in the setting of the study. We have no information about further, unassessed variables that might be related to both our predictors and our outcomes. Thus, the potential of omitted variable bias is undeniable in our study.

Conclusion and Future Directions

Asking students directly in their everyday life when emotions occur is one of the best methods to get natural and accurate data on experienced emotions. ESM allows for a data collection of emotions as closely as possible after they are experienced. This gave us a direct insight into how students regulate their exam-related anxiety. Experimental studies or studies where the participants answer retrospective questionnaires are limited in their conclusions about naturalistic emotions—in contrast, ESM reduces this retrospective bias (Ebner-Priemer & Trull, 2009). The majority of previous emotion regulation studies have not used ESM. But there are a few ESM studies that have investigated the effectiveness of emotion regulation strategies (Brans et al., 2013; Heiy & Cheavens, 2014) and have underscored the importance of examining the use of strategies for specific emotions (Olatunji, Berg, & Zhao, 2017; Tan et al., 2012), considering the situational trigger of the experienced emotion (Heiy & Cheavens, 2014), and investigating different strategies simultaneously (Brans et al., 2013). Brans et al. (2013) highlighted the fact that experience sampling studies and experimental studies on emotion regulation find different results because participants in experimental studies receive detailed information about how to regulate the upcoming emotion. In experience sampling studies, participants are spontaneously regulating their naturally occurring emotions. So we should be careful when comparing studies conducted in different contexts.

To examine the effectiveness of suppression for exam-related anxiety, we should consider not only current mood but also mood over a longer time frame. Previous findings on the negative effect of suppression and positive effect of reappraisal might be related to long-term effects. Since our results address short-term effects, the results should be interpreted with caution. A longitudinal study assessing students' mood during a time span longer than 1 week would be a way to examine longer term effects. Another avenue for future research could be to examine gender effects on the effectiveness of emotion regulation strategies, as there are findings on the effectiveness of some strategies only for women (Brans et al., 2013). An additional avenue for future research is considering whether time spent preparing for the exam has an effect on mood or emotions. According to the process model, this would be a form of situational modification. To get a full overview of the effectiveness of strategies in exam-related contexts, there is also need for exploring other types of emotion regulation strategies, as in Heiy and Cheavens (2014). As we focused on anxiety only, future research could focus on a broader range of emotions to get a better overview of how effective various strategies are for regulating these emotions. To more fully understand the relationship of emotions and emotion regulation strategies, it would be helpful to explore the effects of the strategies depending on the experienced emotion, as it has been shown that the effectiveness of the same strategy differs (a) when regulating two emotions, like fear and disgust (Olatunji et al., 2017), or (b) between sadness, anger, nervousness, and upset (Tan et al., 2012). So future research could explore the effectiveness of emotion regulation strategies for different emotions.

An additional avenue for future research is the relationship between emotion regulation strategies and personality traits. Past research has found that the choice of a specific

emotion regulation strategy may depend on personality traits (Gresham & Gullone, 2012). Our results also indicate that there is a high variation between persons (i.e., up to 37%) in usage of the four regulation strategies. Furthermore, in exam-related situations, it would be helpful to examine the effects of emotion regulation strategies on performance. Future research could potentially identify which strategies help anxious students improve their performance.

Our findings contribute to research on the effects of emotion regulation strategies and suggest that we need to consider the specific context in which the person is experiencing and regulating an emotion. Even though it is assumed that the effectiveness of different emotion regulation strategies is dependent on the specific situation, empirical support for this assumption is lacking. Our study is an important first step to getting a closer look at the effectiveness of these strategies in differing contexts.

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Notes

1. The percentages of the between-persons correlations were between 12% (for context) and 37% (for reappraising anxiety), thus showing the need for a multilevel analysis.

2. The test for the difference in simple slopes has more statistical power than the interaction term test and therefore might detect effects, which interaction term tests do not. Therefore, testing the differences in simple slopes in identifying moderation effects is recommended (Robinson, Tomek, & Schumacker, 2013).

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References

Aldao, A. (2013). The future of emotion regulation research: Capturing context. *Perspectives on Psychological Science*, *8*, 155–172. doi: 10.1177/1745691612459518

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*, 217–237. doi: 10.1016/j.cpr.2009.11.004

Aldao, A., Sheppes, G., & Gross, J. J. (2015). Emotion regulation flexibility. *Cognitive Therapy and Research*, *39*, 263–278. doi: 10.1007/s10608-014-9662-4

Bennett, P., Phelps, C., Brain, K., Hood, K., & Gray, J. (2007). A randomized controlled trial of a brief self-help coping intervention designed to reduce distress when awaiting genetic risk information. *Journal of Psychosomatic Research*, *63*, 59–64. doi: 10.1016/j.jpsychores.2007.01.016

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science*, *8*, 591–612. doi: 10.1177/1745691613504116

Brans, K., Koval, P., Verduyn, P., Lim, Y. L., & Kuppens, P. (2013). The regulation of negative and positive affect in daily life. *Emotion*, *13*, 926–939. doi: 10.1037/a0032400

Brooks, A. W. (2014). Get excited: Reappraising pre-performance anxiety as excitement. *Journal of Experimental Psychology: General*, *143*, 1144–1158. doi: 10.1037/a0035325

Burić, I., Sorić, I., & Penezić, Z. (2016). Emotion regulation in academic domain: Development and validation of the academic emotion regulation questionnaire (AERQ). *Personality and Individual Differences*, *96*, 138–147. doi: 10.1016/j.paid.2016.02.074

Bushman, B. J. (2002). Does venting anger feed or extinguish the flame? Catharsis, rumination, distraction, anger, and aggressive responding. *Personality and Social Psychology Bulletin*, *28*, 724–731.

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *2*, 267–283.

Catterson, A. D., Eldesouky, L., & John, O. P. (2017). An experience sampling approach to emotion regulation: Situational suppression use and social hierarchy. *Journal of Research in Personality*, *69*, 33–43. doi: 10.1016/j.jrp.2016.04.004

Csikszentmihalyi, M., & Larson, R. (1987). Validity and reliability of the experience-sampling method. *Journal of Nervous and Mental Disease*, *175*, 526–536.

Csikszentmihalyi, M., & Larson, R. (2014). Validity and reliability of the experience-sampling method. In M. Csikszentmihalyi (Ed.), *Flow and the foundations of positive psychology: The collected works of Mihaly Csikszentmihalyi* (pp. 35–54). Dordrecht, the Netherlands: Springer. doi: 10.1007/978-94-017-9088-8_3

Dalal, D. K., & Zickar, M. J. (2011). Some common myths about centering predictor variables in moderated multiple regression and polynomial regression. *Organizational Research Methods*, *15*, 339–362. doi: 10.1177/1094428111430540

Ebner-Priemer, U. W., & Trull, T. J. (2009). Ecological momentary assessment of mood disorders and mood dysregulation. *Psychological Assessment*, *21*, 463–475. doi: 10.1037/a0017075

Folkman, S. (1984). Personal control and stress and coping processes: A theoretical analysis. *Journal of Personality and Social Psychology*, *46*, 839–852. doi: 10.1037/0022-3514.46.4.839

Genet, J. J., & Siemer, M. (2012). Rumination moderates the effects of daily events on negative mood: Results from a diary study. *Emotion*, *12*, 1329–1339. doi: 10.1037/a0028070

Goetz, T., & Hall, N. C. (2013). Emotion and achievement in the classroom. In J. Hattie & E. M. Anderman (Eds.), *Educational psychology handbook series. International guide to student achievement* (pp. 192–195). London, UK: Routledge.

Gresham, D., & Gullone, E. (2012). Emotion regulation strategy use in children and adolescents: The explanatory roles of personality and attachment. *Personality and Individual Differences*, *52*, 616–621. doi: 10.1016/j.paid.2011.12.016

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, *74*, 224–237. doi: 10.1037/0022-3514.74.1.224

Gross, J. J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science*, *10*, 214–219. doi: 10.1111/1467-8721.00152

Gross, J. J. (Ed.). (2007). *Handbook of emotion regulation*. New York, NY: Guilford.

Gross, J. J. (2015). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*, 1–26. doi: 10.1080/1047840X.2014.940781

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*, 348–362. doi: 10.1037/0022-3514.85.2.348

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford.

Heiy, J. E., & Cheavens, J. S. (2014). Back to basics: A naturalistic assessment of the experience and regulation of emotion. *Emotion*, *14*, 878–891. doi: 10.1037/a0037231

HLM—Hierarchical Linear and Nonlinear Modeling (Version 7.03). (n.d.). [Computer software]. Skokie, IL: Scientific Software International.

Jamieson, J. P., Mendes, W. B., Blackstock, E., & Schmader, T. (2010). Turning the knots in your stomach into bows: Reappraising arousal improves performance on the GRE. *Journal of Experimental Social Psychology*, *46*, 208–212. doi: 10.1016/j.jesp.2009.08.015

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition & Emotion*, *23*, 4–41. doi: 10.1080/02699930802619031

Levine, L. J., Schmidt, S., Kang, H. S., & Tinti, C. (2012). Remembering the silver lining: Reappraisal and positive bias in memory for emotion. *Cognition & Emotion*, *26*, 871–884. doi: 10.1080/02699931.2011.625403

MovisensXS (Version 0.7.4162). (n.d.). [Computer software]. Karlsruhe, Germany: movisens GmbH.

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2008). Mental toughness, optimism, pessimism, and coping among athletes. *Personality and Individual Differences*, *44*, 1182–1192. doi: 10.1016/j.paid.2007.11.011

Olatunji, B. O., Berg, H. E., & Zhao, Z. (2017). Emotion regulation of fear and disgust: Differential effects of reappraisal and suppression. *Cognition & Emotion*, *31*, 403–410. doi: 10.1080/02699931.2015.1110117

O'Toole, M. S., Jensen, M. B., Fentz, H. N., Zachariae, R., & Hougaard, E. (2014). Emotion differentiation and emotion regulation in high and low socially anxious individuals: An experience-sampling study. *Cognitive Therapy and Research*, *38*, 428–438. doi: 10.1007/s10608-014-9611-2

Parkinson, B., & Totterdell, P. (1999). Classifying affect-regulation strategies. *Cognition & Emotion*, *13*, 277–303. doi: 10.1080/026999399379285

Pekrun, R. (2000). A social-cognitive, control-value theory of achievement emotions. In J. Heckhausen (Ed.), *Motivational psychology of human development: Developing motivation and motivating development* (pp. 143–163). Burlington, VT: Elsevier. doi: 10.1016/S0166-4115(00)80010-2

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, *18*, 315–341. doi: 10.1007/s10648-006-9029-9

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, *36*, 36–48. doi: 10.1016/j.cedpsych.2010.10.002

Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational Psychologist*, *37*, 91–105. doi: 10.1207/S15326985EP3702_4

Robinson, C., Tomek, S., & Schumacker, R. (2013). Tests of moderation effects: Difference in simple slopes versus the interaction term. *Multiple Linear Regression Viewpoints*, *39*, 16–24. Retrieved from http://www.glmj.org/archives/articles/Robinson_v39n1.pdf

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*, 145–172. doi: 10.1037/0033-295X.110.1.145

Schmidt, S., Tinti, C., Levine, L. J., & Testa, S. (2010). Appraisals, emotions and emotion regulation: An integrative approach. *Motivation & Emotion*, *34*, 63–72. doi: 10.1007/s11031-010-9155-z

Schmitz, B. (2001). Self-monitoring zur unterstützung des transfers einer schulung in selbstregulation für studierende [Self-monitoring to support the transfer of a self-regulation instruction for students: A process study]. *Zeitschrift für Pädagogische Psychologie*, *15*, 181–197. doi: 10.1024//1010-0652.15.34.181

Schutz, P. A., Hong, J. Y., Cross, D. I., & Osbon, J. N. (2006). Reflections on investigating emotion in educational activity settings. *Educational Psychology Review*, *18*, 343–360. doi: 10.1007/s10648-006-9030-3

Sheppes, G., & Gross, J. J. (2011). Is timing everything? Temporal considerations in emotion regulation. *Personality and Social PsychologyReview*, *15*, 319–331. doi: 10.1177/1088868310395778

Sheppes, G., Scheibe, S., Suri, G., Radu, P., Blechert, J., & Gross, J. J. (2014). Emotion regulation choice: A conceptual framework and supporting evidence. *Journal of Experimental Psychology: General*, *143*, 163–181. doi: 10.1037/a0030831

Srivastava, S., Tamir, M., McGonigal, K. M., John, O. P., & Gross, J. J. (2009). The social costs of emotional suppression: A prospective study of the transition to college. *Journal of Personality and Social Psychology*, *96*, 883–897. doi: 10.1037/a0014755

Strain, A. C., & D'Mello, S. K. (2011). Emotion regulation during learning. In G. Biswas, S. Bull, J. Kay, & A. Mitrovic (Eds.), *Proceedings of the 15th International Conference on Artificial Intelligence in Education* (pp. 566–568). Berlin/Heidelberg, Germany: Springer. doi: 10.1007/978-3-642-21869-9_103

Strauss, G. P., Ossenfort, K. L., & Whearty, K. M. (2016). Reappraisal and distraction emotion regulation strategies are associated with distinct patterns of visual attention and differing levels of cognitive demand. *PloS One*, *11*, e0162290. doi: 10.1371/journal.pone.0162290

Tan, P. Z., Forbes, E. E., Dahl, R. E., Ryan, N. D., Siegle, G. J., Ladouceur, C. D., & Silk, J. S. (2012). Emotional reactivity and regulation in anxious and nonanxious youth: A cell-phone ecological momentary assessment study. *Journal of Child Psychology and Psychiatry*, *53*, 197–206. doi: 10.1111/j.1469-7610.2011.02469.x

Wilhelm, P., & Schoebi, D. (2007). Assessing mood in daily life. *European Journal of Psychological Assessment*, *23*, 258–267. doi: 10.1027/1015-5759.23.4.258

Zirkel, S., Garcia, J. A., & Murphy, M. C. (2015). Experience-sampling research methods and their potential for education research. *Educational Researcher*, *44*, 7–16. doi: 10.3102/0013189X14566879

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