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Emotions and emotion regulation in undergraduate studying: examining students' reports from a self-regulated learning perspective

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Emotions and emotion regulation in undergraduate studying: examining students' reports from a self-regulated learning perspective

This study examined undergraduate students' reports of emotions and emotion regulation during studying from a self-regulated learning (SRL) perspective. Participants were 111 university students enrolled in a first-year course designed to teach skills in SRL. Students reflected on their emotional experiences during goal-directed studying episodes at three times over the semester. Measures included self-evaluations of goal attainment, emotion intensity ratings, and open-ended descriptions of emotion regulation strategies. Findings generally revealed that positive emotions were positive predictors and negative emotions were negative predictors of self-evaluations of goal attainment, although positive emotions were associated with larger changes in self-evaluations. Boredom was analysed separately and was found to be a positive predictor at the between-person level but not a predictor at the within-person level. Finally, students reported (a) enacting a variety of strategies to regulate their emotions and (b) using a different strategy more often than the same strategy from one study session to the next.

Keywords: emotions; emotion regulation; self-regulated learning; self-evaluations of goal attainment

Successful students pro-actively and strategically regulate their cognitions, motivational states, and behaviours (Zimmerman, 1986). These students engage in productive self-regulated learning (SRL) by setting high-quality goals, selecting appropriate tactics to achieve those goals, monitoring progress, and adapting as necessary (Winne & Hadwin, 2008; Zimmerman, 1990). Various key processes involved in SRL have been examined in different ways over the years (e.g., see Zimmerman, 2008); however, the role of emotions in SRL has received comparatively little attention. Researchers have recently emphasized the importance of emotions and emotion regulation in theories of SRL (e.g., Ben-Eliyahu & Linnenbrink-Garcia, 2012; Boekaerts, 2007), and empirical research indicates that emotions are a significant aspect of the learning process. For example, research examining emotions in educational contexts links emotions to academic

performance (e.g., Pekrun, Elliot, & Maier, 2009; Pekrun, Goetz, Titz, & Perry, 2002; Ruthig et al., 2008); engagement and flow experiences (e.g., Ainley & Ainley, 2011; Meyer & Turner, 2002, 2006; Pekrun & Linnenbrink-Garcia, 2012; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003); and several self-regulatory constructs, such as achievement goal orientations (e.g., Daniels et al., 2008; Pekrun et al., 2009), goals for performance (e.g., Ilies & Judge, 2005), the use of learning strategies (Pekrun et al., 2002; Shell & Husman, 2008), and self-reported SRL (e.g., Howell & Buro, 2010; Pekrun et al., 2002; Villavicencio & Bernardo, 2012). There remain, however, some under-examined areas of research that are of relevance at the university level. In particular, few studies have examined undergraduate students' experiences and regulation of emotions in their self-directed, day-to-day studying activities.

Achievement emotions

The ways in which emotions are defined in the literature vary; however, predominant definitions indicate emotions are composed of (a) affective experiences or feelings, (b) physiological responses, (c) cognitive processes, (d) behaviours or expressions, and/or (e) action tendencies (Kleinginna & Kleinginna, 1981; Scherer, 2005; Solomon, 2008). Rosenberg (1998) situates emotions within the more general category of affect and distinguishes emotions from mood on the basis of intensity, duration, and focus. In particular, emotions are more intense and less enduring than moods, and emotions occur in response to environmental stimuli, whereas moods do not necessarily have an identifiable cause. Emotions can also be described in terms of their underlying dimensions. Two predominant dimensions in the literature are valence (the degree to which an emotion is pleasant or unpleasant) and activation (the degree to which an emotion is mobilizing or energizing; e.g., Russell, 1980; Russell & Barrett, 1999).

In academic contexts, Pekrun and his colleagues (e.g., Pekrun et al., 2002) have focused their research on achievement emotions, which are emotions that occur specifically in relation to academic activities and outcomes (Pekrun, 2006). In the past, research on achievement emotions has focused largely on test anxiety and—to a much lesser extent—other emotions related to achievement outcomes (i.e., success and failure; Pekrun et al., 2002). However, Pekrun et al. (2002) convincingly argued that students may experience a diverse range of positive and negative emotions related to achievement outcomes as well as activities that produce those outcomes. As such, research examining a variety of emotions during academic activities, such as studying, can offer valuable information to enhance understanding of the emotional and learning experiences of students. According to Pekrun's control-value theory of achievement emotions (Pekrun, Frenzel, Goetz, & Perry, 2007; Pekrun et al., 2002) the dimensions of valence and activation are important for predicting several academic outcomes. For example, positive activating emotions (e.g., enjoyment, hope, and pride) may increase motivation, facilitate the use of flexible learning strategies (e.g., elaboration), and increase performance. On the other hand, negative deactivating emotions (e.g., hopelessness and boredom) may decrease motivation and performance, and negative activating emotions (e.g., anger, anxiety, and shame) may facilitate the use of less flexible learning strategies (e.g., rehearsal). In addition, Pekrun et al. (2007) acknowledge these relations are likely bidirectional and reciprocal.

Emotions in self-regulated studying

Examining self-regulatory processes that occur during independent studying is especially relevant at the university level where a large proportion of learning takes place outside of formal class time. Students are responsible for planning and regulating studying with limited opportunities for external guidance or feedback, something that may be unfamiliar for first-year

students in particular. As such, students' self-paced studying episodes are an important context for investigating students' emotions and the regulation of those emotions.

The role of emotions in self-regulated studying can be described using Winne and Hadwin's (1998, 2008) model of SRL as a framework. Their model is appropriate because it clearly defines how successful students self-regulate their studying. In particular, Winne and Hadwin (1998, 2008) propose four recursively linked phases of studying: (a) defining task perceptions, (b) setting goals and planning, (c) enacting strategies to achieve goals, and (d) performing small- and large-scale adaptation within and across phases of SRL on the basis of metacognitive monitoring and evaluating. According to Winne and Hadwin's (1998, 2008) COPES framework, emotions can occur as both internal conditions for each phase and products of each phase. As conditions, emotions influence learning and how students engage in studying. For example, experiencing shame about not understanding a task may prevent a student from asking for help, which in turn may inhibit potential to set productive goals for studying. As products, emotions result from performing operations or evaluating other products. For example, evaluating task progress as not satisfactory with respect to goals for that task may result in feelings of frustration or anger, which in turn become conditions for subsequent actions. This description of the role of emotions in SRL aligns well with Carver and Scheier's (1990, 2000) control-process model in which emotions arise from perceptions of progress by comparing one's current state with one's desired state, subsequently directing further actions. Limited research findings indicate that emotions are connected to perceptions of progress during studying (Pekrun, Goetz, Daniels, Stupinsky, & Perry, 2010, Study 2) as well as perceptions of performance after studying (Boekaerts, 2007). No research was found, however, that examined students' emotions in relation to their self-evaluations of attaining self-set studying goals.

Regulation of emotions

From an SRL perspective, it is important to not only examine the role of students' emotions during studying, but to also examine how students manage those emotions in pursuit of their studying goals. In educational research, the regulation of emotions has been an under-examined area (Pekrun & Linnenbrink-Garcia, 2012), although research is emerging (e.g., Ben-Eliyahu & Linnenbrink-Garcia, 2012; Davis, DiStefano, & Schutz, 2008; Nett, Goetz, & Hall, 2011).

Gross (1998) defines emotion regulation as 'the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions' (p. 275). In his process model, Gross outlines five types of strategies for regulating emotions: (a) situation selection (approaching or avoiding particular people, places, or objects), (b) situation modification (directly altering external aspects of a situation), (c) attentional deployment (refocusing attention on or distracting attention away from certain aspects of a situation), (d) cognitive change (modifying appraisals or interpretations of the situation), and (e) response modulation (directly altering emotional responses to a situation, such as by using drugs, practising relaxation techniques, or suppressing the emotion). The first four strategies are considered antecedent-focused (i.e., occurring prior to the emotion) whereas the fifth strategy is considered response-focused (i.e., occurring in response to the emotion). Although other frameworks of emotion regulation have been used in academic research, Gross's model is a good starting point for investigating the strategies students report using during studying because it is a relatively general model that incorporates components of other models used in educational research (e.g., Nett et al., 2011; Schutz, DiStefano, Benson, & Davis, 2004) and it is not specific to one context.

Empirical research on Gross's (1998) model has predominantly focused on the strategies of cognitive change (reappraisal) and suppression. Findings indicate that reappraising a situation is typically associated with beneficial effects, such as greater experience of positive emotions, diminished experience of negative emotions, and higher levels of positive functioning (Ben-Eliyau & Linnenbrink-Garcia, 2012; Gross & John, 2003; Nett et al., 2011). In contrast, suppressing emotions is typically associated with detrimental effects, such as diminished experience of positive emotions, greater experience of negative emotions, and lower levels of positive functioning (Ben-Eliyau & Linnenbrink-Garcia, 2012; Gross & John, 2003; Srivastava, Tamir, McGonigal, John, & Gross, 2009). Overall, the little research that has been conducted in educational contexts indicates that emotion regulation matters. However, we know little about the extent to which students use a variety of emotion regulation strategies during real-life studying episodes.

Purpose and research questions

The purpose of this study was to examine the emotions undergraduate students experience and how they regulate those emotions while working towards self-set studying goals during day-to-day studying. Specifically, we sought to contribute to SRL theory and research by answering two research questions:

- (1) How do the type and intensity of students' reported emotions relate to self-evaluations of goal attainment for specific studying episodes? On the basis of past research findings (Boekaerts, 2007; Pekrun et al., 2009; Pekrun et al., 2002; Ruthig et al., 2008), we hypothesized that the intensity level of positive emotions would positively correlate with

self-evaluations of goal attainment and the intensity level of negative emotions would negatively correlate with self-evaluations of goal attainment.

- (2) What strategies do students report using to regulate their emotions while engaged in day-to-day studying? Unlike much of the past research that has (a) focused on a limited number of strategies, such as cognitive reappraisal and suppression (e.g., Gross & John, 2003; Srivastava et al., 2009) or (b) examined emotion regulation mainly in the context of test taking (e.g., Davis et al., 2008; Schutz & Davis, 2000), we sought to explore the strategies students enact while working on a variety of studying activities and tasks.

Furthermore, in previous studies, students are often asked to report their experiences at one point in time or generalized across times, making it difficult to account for effects that occur within individuals over time. An important addition to this research is acquiring students' reports at multiple points in time in order to examine the effects at both between-person and within-person levels. Thus, we obtained students' reports of their emotional experiences during three study sessions spaced out over a semester.

Methods

Participants

Participants were 111 undergraduate students (72 female; 39 male) enrolled in a first-year, elective, undergraduate course designed to support students to develop SRL knowledge and skills. Table 1 contains demographic information. Students were from a variety of faculties, and the majority of students were in their first or second year of university.

Table 1. Demographics.

	<i>n</i>	<i>M</i>	<i>SD</i>
Gender			
Female	72		
Male	39		
Faculty			
Social Sciences / HSD	55		
Humanities / Fine Arts	29		
Science / Engineering	17		
Business	10		
Year			
First	72		
Second	21		
Third	5		
Fourth and higher	3		
Age in years	111	19.5	4.15
High school average (%)	90	79.75%	6.34
Term GPA (9-point scale)	111	4.97	1.98

Note. HSD = Human and Social Development.

Research context

The SRL course is a semester-long, credit-bearing course offered to undergraduate students at a mid-sized Canadian university. The course uses a model of SRL as a framework for guiding students to develop the knowledge and skills necessary to become productive self-regulated learners. Specifically, students are taught how to develop accurate and complete task perceptions, set productive goals that are specific and limited to short-term study sessions (e.g., Locke & Latham, 2002), strategically choose and experiment with tactics to achieve those goals, monitor their progress, and make adjustments to their studying as necessary.

Measures

Personal Planning Tool (PPT)

All data analysed in this study were from an electronic, diary-like tool developed for the course and completed by students on a weekly basis throughout the semester. The Personal Planning Tool (PPT) encouraged students to engage in self-regulated studying by (a) planning for an upcoming study session by setting a goal and rating the challenge level of the goal as well as their confidence in attaining the goal and (b) reflecting on the study session by reporting how well they attained their goal in the previous week and what challenges they encountered (see Appendix A). The design of the PPT acknowledges that students study across tasks and courses throughout the week and need to learn to make use of past experiences and reflections about studying to optimize progress on a set of new domains and studying activities that present themselves for the upcoming week.

In the third, sixth, and ninth weeks of the course, the reflection section of the PPT contained questions about students' emotions and emotion regulation strategies while trying to achieve their goal. We chose these three time points to capture students' experiences at the beginning, middle, and end of the semester. For this study, we analysed data from three of the emotion items along with students' self-evaluations of goal attainment, described next.

Self-evaluations of goal attainment. Students rated how successful they were in attaining the goal they set the previous week on a scale from 1 (*not very successful*) to 10 (*very successful*). These self-evaluations are important for SRL, especially when students engage in independent study sessions for which they may receive no external feedback regarding progress. In Winne

and Hadwin's (1998, 2008) model of SRL, monitoring and evaluating occur throughout the phases and form the basis for change when things are not going as expected.

Intensity of achievement emotions. After indicating how successful they were in attaining their goal, students reflected on the emotions they may have experienced while working towards their goal. They were asked to rate the intensity level of the following nine emotions on a scale from 1 (*not at all*) to 10 (*extremely*): enjoyment, hope, pride, relief, anger, anxiety, shame, boredom, and hopelessness. These emotions were adopted from the Achievement Emotions Questionnaire (AEQ; Pekrun, Goetz, & Perry, 2005), which was developed on the basis of (a) previous research showing these emotions to be frequently experienced by post-secondary students (Pekrun et al., 2002) and (b) the desire to represent four categories of emotions: positive activating (enjoyment, hope, pride), positive deactivating (relief), negative activating (anger, anxiety, shame), and negative deactivating (boredom, hopelessness). In addition to the nine emotions, students had the option to add another emotion to the list if they felt the predefined list did not capture all the feelings they experienced.

Emotional challenge. From the list of emotions evaluated previously, students were asked to report one emotion they perceived to negatively affect their goal progress.

Emotion regulation strategy. Finally, students were asked to describe what they did to change the emotion they perceived as interfering with progress. A predefined list of strategies was not used because little research has been done examining the specific strategies students use to regulate emotions during independent studying. Rather, students described their strategy in an open-ended text field. Having students reflect on a salient emotional challenge and how they addressed that challenge is important for regulation. A self-regulating learner would use this

information to plan ahead and adapt their studying as necessary to avoid or more effectively address a future similar challenge.

Procedure

At the beginning of the semester, students were informed about the study and asked to indicate their consent via an electronic version of the information consent letter (made available on the course website throughout the semester). Students accessed the weekly PPT through the course website, which was hosted by an online open source course management system (Moodle [Version 1.9]; Dougiamas, 1999). They were given approximately 10 to 15 minutes at the beginning of each lab to complete the PPT before moving on to other lab activities. If they were not finished, they could access and finish the PPT after lab. The third, sixth, and ninth PPTs comprise the data for this study. The topic of motivation and emotion was taught in the last week of the course; thus, students were not formally introduced to emotions and emotion regulation strategies until after data collection for this study was complete.

Findings

How do the type and intensity of students' reported emotions relate to self-evaluations of goal attainment for specific studying episodes?

Preliminary analysis

Descriptive statistics for the intensity level of each emotion organized by two subscales (positive and negative valence) at Times 1 to 3 are provided in Table 2. Cronbach's alpha for the positive and negative emotion scales are provided for each time. Subscales were developed in order to minimize the number of variables included in subsequent analyses. In line with theory (e.g.,

Pekrun et al., 2007; Russell & Barrett, 1999), emotions were initially organized into four categories on the basis of valence and activation: positive activating, positive deactivating, negative activating, and negative deactivating. To check the appropriateness of combining the emotions in this way, we examined correlations among the scales as well as internal consistency of each scale (excluding positive deactivating, which contained only relief). Correlations revealed a strong positive relation ($r = .57$) between positive activating and positive deactivating emotions as well as strong positive relation ($r = .56$) between negative activating and negative deactivating emotions, suggesting that the positive scales could be combined and the negative scales could be combined.

Table 2. Intensity of students' emotions at each time.

	Time 1				Time 2				Time 3			
	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α	<i>n</i>	<i>M</i>	<i>SD</i>	α
Positive emotions	99	6.3	1.8	.77	93	5.7	2.1	.80	82	6.24	1.93	.77
Relief	106	6.7	2.8		97	6.2	3.0		88	6.9	2.7	
Hope	107	6.4	2.2		95	6.0	2.3		88	6.2	2.4	
Pride	107	6.4	2.3		96	5.6	2.7		87	6.4	2.4	
Enjoyment	105	5.2	2.5		96	4.8	2.5		85	5.3	2.6	
Negative emotions	99	4.0	2.0	.80	93	3.8	2.2	.85	82	3.41	1.71	.76
Anxiety	106	5.3	2.6		96	5.3	2.8		88	4.8	2.5	
Anger	107	3.8	2.6		96	3.6	2.5		87	3.4	2.3	
Hopelessness	107	3.6	2.7		96	3.7	2.8		88	2.9	2.3	
Shame	107	3.0	2.5		96	2.8	2.5		87	2.6	2.1	
Boredom	99	5.5	2.7		93	5.3	2.7		82	5.4	2.5	
Goal attainment	99	7.0	2.4		93	7.6	2.7		82	8.1	2.1	

Note. The *n* for each time differs due to missing data as a result of class absences. Emotions were rated on a scale from 1 (*not at all*) to 10 (*extremely*). Goal attainment refers to self-evaluations of goal attainment and was rated on a scale from 1 (*not very successful*) to 10 (*very successful*).

Scale reliability analysis indicated that relief (the sole positive deactivating emotion) fit well with the other positive emotions and increased the alpha. With respect to negative deactivating emotions (hopelessness and boredom), not only was this scale positively correlated

with the negative activating scale, these two emotions did not fit well on the same scale, with item-total correlations ranging from .04 (at Time 3) to .20 (at Time 1). When added to the negative activating scale, we discovered that hopelessness fit well with the other negative emotions, but boredom did not, with item-total correlations ranging from .12 (Time 3) to .14 (Time 2). Boredom was, therefore, removed from the scale. However, boredom was included in subsequent analyses as an independent factor because it was the most frequently identified emotional challenge (see Table 3).

Table 3. Proportion of students selecting each emotion as negatively affecting goal progress.

Emotion	Time 1		Time 2		Time 3		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Boredom	53	48.6	38	37.3	39	39.4	130	41.9
Anxiety	29	26.6	30	29.4	30	30.3	89	28.7
Hopelessness	12	11.0	12	11.8	7	7.1	31	10.0
Other negative ^a	5	4.6	11	10.8	9	9.1	25	8.1
Anger	4	3.7	6	5.9	7	7.1	17	5.5
Enjoyment	2	1.8	3	2.9	1	1.0	6	1.9
Shame	3	2.8	1	1.0	2	2.0	6	1.9
None ^b	0	0.0	0	0.0	3	3.0	3	1.0
Pride	1	0.9	1	1.0	0	0.0	2	0.6
Relief	0	0.0	0	0.0	1	1.0	1	0.3
Total	109	100.0	102	100.0	99	100.0	310	100.0

^aSome students identified emotions other than the nine emotions provided to them. ^bNone refers to responses in which students indicated they did not experience an emotional challenge.

Although activation is theoretically an important dimension in terms of academic outcomes (e.g., Linnenbrink, 2007; Pekrun et al., 2007), given that (a) we had few emotion items per category (e.g., relief was the only positive deactivating emotion), (b) organizing emotions along both dimensions did not improve the subscale alphas (and revealed a low alpha for negative deactivating emotions), and (c) no empirical studies were located that have established the reliability of these subscales using these particular emotions, it is difficult to justify the use of

four categories rather than the more parsimonious two categories. We acknowledge, however, that with a different set of emotions and/or more items assessing each dimension, it may be possible to create and utilize more fine-tuned categories in analysis. For example, Linnebrink-Garcia, Rogat, and Koskey (2011) created four scales that attained adequate reliability when examining affect during group work; however, the items on the measures were quite different from the discrete emotions assessed in our study (e.g., negative deactivating items included tired, sleepy, and worn out).

Multilevel analysis of emotions as predictors of self-evaluations of goal attainment

Multilevel linear modelling was used to examine the relation between students' emotions and self-evaluations of goal attainment across the three time points. A two-level model was developed to predict self-evaluations of goal attainment from positive emotions, negative emotions, and boredom. All models were estimated in Mplus using maximum likelihood (ML). The statistical significance of individual fixed effects was evaluated using Wald tests, and the statistical significance of groups of fixed effects as well as random effects was evaluated by comparing nested models with ML deviance difference tests. Because students missed class on occasion or missed some items on the PPT, not all cases were complete. Out of a possible 333 cases, 11 cases were missing ratings on one variable and 42 cases were missing ratings on more than one variable. For those cases missing ratings on one variable, the missing value was replaced with the variable mean; the remaining 42 cases were deleted. This resulted in a final total of 291 cases, with students providing a mean of 2.6 complete cases.

Descriptive statistics for each variable are provided in Table 4. With the exception of boredom, all variables demonstrated statistically significant positive or negative skewness. Square root transformations improved skewness for all variables, but worsened kurtosis for

positive emotions and negative emotions (see Table 4). Analyses performed with both untransformed and transformed variables produced similar results, with one exception for negative emotions. In the interest of interpretability, we report results using untransformed variables; however, we will note the discrepant result for negative emotions where appropriate. No univariate or multivariate outliers were detected, and collinearity among predictors did not pose a problem.

Table 4. Descriptive statistics of variables analysed in multilevel modelling.

Variable	<i>M</i>	<i>SD</i>	Untransformed		Transformed	
			Skewness	Kurtosis	Skewness	Kurtosis
Self-evaluations of goal attainment	7.54	2.41	-1.18*	0.80	0.55*	-0.40
Positive emotions	6.02	2.00	-0.57*	-0.16	0.11	-0.44
Negative emotions	3.76	2.04	0.64*	-0.49	0.20	-0.88
Boredom	5.43	2.64	-0.18	-0.93		

Note. All variables were measured on a scale from 1 to 10.

* $p < .001$.

An empty means, random intercept model revealed an intraclass correlation of 0.11, indicating that approximately 11% of the variance in self-evaluations of goal attainment was between persons. A 95% random effects confidence interval indicated that mean self-evaluations of goal attainment were predicted to range from 5.99 to 9.09 (on a scale from 1 to 10). A fixed linear effect of time, centred at Time 1, was added to the model and found to be statistically significant. The addition of a random effect of time did not further improve model fit, $\chi^2(2) = 1320.52 - 1320.16 = 0.36, p > .05$, thus it was not included in subsequent models. The baseline model, including only the fixed effect of time, is shown in the first column of Table 5.

Next, we added the fixed effects of the predictors to the model. Intraclass correlations for positive emotions, negative emotions, and boredom (calculated from separate empty means, random intercept models) were .23, .39, and .35 respectively, suggesting that inclusion of both

within-person and between-person effects as predictors of self-evaluations of goal attainment would be appropriate. As such, each predictor was person-mean-centred so that (a) its within-person effect was centred at each student’s personal mean intensity score across weeks and (b) its between-person effect was centred at the overall sample mean intensity score for that variable (see Table 4 for means and standard deviations for each variable).

Table 5. Model results for predicting self-evaluations of goal attainment from positive emotions, negative emotions, and boredom.

Model effects	Fixed linear time, random intercept (baseline model)			Fixed effects of predictors		
	Estimate	SE	<i>p</i>	Estimate	SE	<i>p</i>
Model for the means						
β_0 intercept						
Intercept	7.01	0.21	<.001	7.04	0.16	<.001
BP positive emotions				0.51	0.09	<.001
BP negative emotions				-0.33	0.08	<.001
BP boredom				0.13	0.06	.018
β_1 linear time	0.19	0.05	<.001	0.18	0.04	<.001
β_2 WP positive emotions				0.72	0.08	<.001
β_3 WP negative emotions				-0.15 ^a	0.09	.109
β_4 WP boredom				0.06	0.06	.322
Model for the variance						
τ_{U0}^2 random intercept variance	0.77	0.39	.051	0.29	0.22	.188
σ_e^2 residual variance	4.79	0.50	<.001	2.94	0.31	<.001
Model fit						
Number of parameters	4			10		
-2 log likelihood	1320.52			1164.84		
AIC	1328.52			1184.84		
BIC	1343.22			1221.58		

Note. Bold values are $p < .05$. BP = between person. WP = within person.

^aWithin-person negative emotions were statistically significant ($p < .05$) when using transformed variables.

The addition of the predictors improved model fit over the unconditional baseline model, $\chi^2(6) = 1320.52 - 1164.84 = 155.68, p < .001$. Furthermore, residual variance was reduced by 38.6% and intercept variance was reduced by 62.3%. Adding random effects of each either did not improve model fit or caused convergence issues, and were therefore not included in the final

model. The final model is shown in the second column of Table 5. Each of the between-person effects was statistically significant, whereas only the within-person effect of positive emotions was statistically significant. However, when using transformed variables, the effect of within-person negative emotions was statistically significant ($p < .05$).

Results of the final model indicate the following: At the beginning of the semester (Time 1), the expected level of self-evaluations of goal attainment is 7.04 for students who (a) report a mean level of intensity across time for all variables and (b) report their own personal mean level of intensity at Time 1 for all variables. Holding everything else constant, self-evaluations of goal attainment are expected to increase by 0.18 units per time period. In terms of between-person effects, results indicate that (a) students with higher mean intensity scores of positive emotions rate their goal attainment at a higher level (i.e., for every one unit increase in mean positive emotions, self-evaluations of attainment increase by 0.51 units), (b) students with higher mean intensity scores of negative emotions rate their goal attainment at a lower level (i.e., for every one unit increase in mean negative emotions, self-evaluations of goal attainment decrease by 0.33 units), and (c) students with higher mean intensity scores of boredom rate their goal attainment at a higher level (i.e., for every one unit increase in mean boredom, self-evaluations of goal attainment increase by 0.13 units). Finally, with respect to within-person effects, results indicate that when students report higher than usual positive emotions in a study session, they also report higher levels of goal attainment (i.e., for every one unit increase in positive emotions, self-evaluation of goal attainment increases by 0.72 units). It is also worth noting that results using transformed variables suggest that when students report higher than usual negative emotions in a study session, they also report lower goal attainment. Within-person effects of boredom, on the other hand, were not statistically significant using either untransformed or

transformed variables, suggesting no relation between level of boredom during a specific study session and self-evaluations of goal attainment.

Examination of the parameter estimates indicates that positive emotions had larger effects than negative emotions or boredom on self-evaluations of goal attainment at both the between-person and within-person levels. The largest effect occurred at the within-person level, where reporting more intense positive emotions than usual in a study session predicted an increase in goal attainment of 0.72 units. At the between-person level, more intense positive emotions predicted an increase in goal attainment of 0.51 units. Considering self-evaluations of goal attainment were expected to increase by 0.18 units per time holding all predictors constant, these effects appear to be fairly strong.

To summarize, our hypotheses were mainly supported by results of the multilevel analysis, with the exception of boredom. In particular, positive emotions positively predicted self-evaluations of goal attainment at both the between-person and within-person level, and negative emotions negatively predicted self-evaluations of goal attainment at the between-person level and tentatively at the within-person level. Boredom, which is considered a negative emotion, did not perform in the way we expected. That is, rather than negatively predicting self-evaluations of goal attainment, boredom positively predicted self-evaluations at the between-person level and did not predict self-evaluations of goal attainment at the within-person level.

What strategies do students report using to regulate their emotions while engaged in day-to-day studying?

After rating the intensity level of the emotions they may have experienced while working towards their goal, students selected one emotion that negatively affected their progress and described what they tried to do to change that emotion. Open-ended statements about emotion

regulation strategies were coded as follows. In the first iteration of coding, statements were coded using the five categories proposed by Gross (1998): situation selection, situation modification, attentional deployment, cognitive change, and response modulation. When statements contained more than one strategy, the first identifiable strategy was coded. During the first iteration, predominant emergent themes were also noted and used to refine the coding categories. This resulted in 11 categories of emotion regulation strategies that were used to complete a second round of coding. Once this was complete, a second researcher coded a random subset of 50 responses. An acceptable Cohen's kappa of .90 was obtained. Table 6 contains descriptions of each of the 11 categories and the frequency with which students reported using each type of strategy at each time and overall. In addition, Table 7 displays the distribution of strategies for the top two emotional challenges (boredom and anxiety) and the other emotional challenges combined. A discussion of each category with examples of students' coded statements is presented next in order of overall reported frequency of strategy use.

Table 6. Descriptions, examples, and frequencies of coded emotion regulation strategies.

Strategy	Description	Time 1		Time 2		Time 3		Overall	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Task/goal management	Managing some aspect of the task or goal, such as making schedules, organizing work, breaking the task into smaller pieces, or taking breaks.	23	21.5	28	27.5	21	21.0	72	23.3
Task focus	Focusing on the task at hand rather than the challenging emotion, or speeding up task completion in order to eliminate the feeling associated with it.	21	19.6	12	11.8	16	16.0	49	15.9
Task enactment	Enacting the task in a different way or changing strategies.	13	12.1	9	8.8	12	12.0	34	11.0
Self-consequating thoughts/actions	Thinking about the consequences of finishing or not finishing the task or rewarding oneself for completing the task.	14	13.1	11	10.8	5	5.0	30	9.7
Social support	Seeking help from peers or instructors, or simply talking or studying with friends.	5	4.7	9	8.8	11	11.0	25	8.1
Enhancing competence	Enhancing competence or learning in order to reduce a challenging emotion.	4	3.7	11	10.8	6	6.0	21	6.8
Task avoidance	Avoiding the task altogether or avoiding a specific aspect of the task.	6	5.6	5	4.9	8	8.0	19	6.1
Cognitive change ^a	Altering one's thinking or perceptions related to the task, such as by thinking positively about the task or thinking about the value or importance of the task.	7	6.5	5	4.9	6	6.0	18	5.8

(continued)

Table 6. Descriptions, examples, and frequencies of coded emotion regulation strategies (continued).

Strategy	Description	Time 1		Time 2		Time 3		Overall	
		<i>f</i>	%	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Response modulation ^a	Directly changing an emotion, such as taking deep breaths or trying to relax or calm down.	7	6.5	4	3.9	4	4.0	15	4.9
Do nothing	Doing nothing to change one's emotions, sometimes indicating that the emotion was beneficial.	3	2.8	4	3.9	7	7.0	14	4.5
Environment management	Altering the environment to regulate one's emotion. This included studying in a different location, such as the library, or changing something within the environment, such as listening to music while working.	4	3.7	4	3.9	4	4.0	12	3.9
Total frequency of strategies reported at each time and overall		107		102		100		309	

^aAlso one of Gross's (1998) categories.

Table 7. Overall frequency of strategies reported for boredom, anxiety, and other emotional challenges combined.

Strategy	Boredom		Anxiety		Other emotions	
	<i>f</i>	%	<i>f</i>	%	<i>f</i>	%
Task/goal management	36	27.7	20	23.0	12	14.1
Task focus	18	13.8	15	17.2	15	17.6
Task enactment	20	15.4	6	6.9	6	7.1
Self-consequating thoughts/actions	17	13.1	7	8.0	7	8.2
Social support	4	3.1	9	10.3	12	14.1
Enhancing competence	2	1.5	8	9.2	10	11.8
Task avoidance	10	7.7	1	1.1	7	8.2
Cognitive change ^a	4	3.1	10	11.5	6	7.1
Response modulation ^a	2	1.5	8	9.2	5	5.9
Do nothing	7	5.4	1	1.1	5	5.9
Environment management	10	7.7	2	2.3	0	0
Total frequency	130	100.0	87	100.0	85	100.0

Task/goal management strategies were most frequently described by students across all three time periods. In addition, these strategies were reported more often than other strategies for regulating boredom and anxiety than other emotional challenges. Task/goal management strategies involved attempting to manage some aspect of the academic task or goal, such as making schedules, organizing work, breaking the task into smaller pieces, and, most frequently, taking breaks. For example, three students reported the following (note that information in parentheses represents participant number, time, and emotional challenge indicated by participant, respectively):

- ‘I tried to set specific goals on how to accomplish all of the readings. Rather than attempting to get it all done in one sitting, I tried to only get through 10 pages at a time, than take a break or do some other work and then come back to it’ (P122, Time 1, Boredom).
- ‘Spread out my studying into smaller chunks over the week rather than a long study period’ (P123, Time 2, Boredom).
- ‘I would start earlier. I figured that if I started earlier and was more prepared I would have more time to edit the paper and feel more relaxed’ (P159, Time 3, Anxiety).

Task focus strategies were reported second most frequently by students overall, with most occurring at Time 1 and the fewest occurring at Time 2. These strategies involved focusing on the task at hand rather than the challenging emotion or speeding up task completion in order to eliminate the feeling associated with it. Students wrote statements such as the following:

- ‘I tried to ignore it and just get on with my work’ (P146, Time 1, Boredom).

- ‘I did not allow my emotions to control me, because my feelings toward the assignment were irrelevant and I wanted to complete it before the weekend so I put my mind to it and accomplished this task’ (P67, Time 1, Boredom).
- ‘I tried to keep my mind on track and repeatedly tell myself that I needed to get my work done. This kept me from getting distracted and I was able to finish my work quicker’ (P150, Time 3, Boredom).

Task enactment strategies can be defined in terms of Winne and Hadwin’s (1998) model of SRL, in which task enactment is the third phase of using tactics and strategies to accomplish goals. Thus, task enactment strategies in emotion regulation refer to changing the approach used to tackle the task in order to manage an undesirable emotion. These strategies were reported third most frequently overall and appeared to be more dominant for regulating boredom than anxiety or other emotional challenges. Students wrote statements such as the following:

- ‘I tried to brainstorm personal experiences, thoughts and emotions that I could relate to the image I was responding to and draw on that to create an interesting piece of writing’ (P82, Time 1, Anxiety).
- ‘I chose the topic that appeared to be the most appealing to me, and once I researched it I found that parts of it were actually sort of interesting, which motivated me to find out more about it’ (P102, Time 2, Boredom).
- ‘I started making cue-cards to accompany my reading and studying’ (P142, Time 1, Boredom).

Self-consequating thoughts and actions refer to thinking about the consequences of finishing or not finishing the task or administering rewards for completing the task. Students

reported a decreasing use of these strategies over time. Similar to task enactment strategies, students appeared to use these strategies more often for regulating boredom than anxiety or other emotional challenges. Examples of self-consequating thoughts include the following:

- ‘I reminded myself of how horrible it was on the last written assignment, when I left it all for the day before, and how much I want to avoid that’ (P141, Time 3, Relief).
- ‘Try to think about how proud I would be if I could achieve my goal’ (P168, Time 1, Anxiety).

Examples of self-consequating actions include the following:

- ‘To try to change the feeling I motivated myself by saying, If I finished a certain number of pages while fully understanding the meaning I could watch my show that night or hang out with my friends’ (P86, Time 1, Boredom).
- ‘I tried to just encourage myself to get it done by giving myself small rewards for completing steps in the progress. For example I would take 30 minute breaks every time I completed a chapter. I found this strategy worked for me, because it sort of felt like I was playing a game and that there was something positive on the other side’ (P113, Time 2, Boredom).

Social support strategies refer to seeking help from peers or instructors, or simply talking to or studying with friends. Students reported increasing use of these strategies over time, although they only reported using these strategies about 8% of the time overall. Social support appeared to be used more often for regulating anxiety and other emotional challenges than for regulating boredom. Examples of social support strategies include the following:

- ‘To try and change my feeling of hopelessness I met up with other students in my class to discuss their ideas about how to answer the study questions (aka. essay topics for the midterm) as well as to go over concepts I didn't fully understand’ (P84, Time 2, Hopelessness).
- ‘I tried to get help from my peers and my lab instructor and it really helped me understand a couple of the concepts I did not understand before’ (P136, Time 3, Hopelessness).
- ‘I ask[ed] one of my friends to work with me when I’m working on the exam. Even though she is not in the class, having someone to work with reduce[s] the feeling of boredom from the task’ (P115, Time 3, Boredom).

Enhancing competence involves attempts to learn the material better in order to reduce a challenging emotion. These strategies were reported least frequently at Time 1 and most frequently at Time 2. Similar to social support strategies, students rarely used enhancing competence strategies to regulate their boredom, whereas they appeared to use these strategies more often to regulate anxiety and other emotional challenges. Following are representative statements in this category:

- ‘I overcame the Anger by trying to learn from each question so as to avoid future mistakes (as well as the future feelings of anger associated with that)’ (P128, Time 1, Anger).
- ‘I just tried to relax and learn the material really well so I would have no reason to be anxious’ (P159, Time 2, Anxiety).

- ‘I just kept on doing exercises until I got to a point where I got most of the questions right and I got more excited every time I got a question right’ (P98, Time 3, Boredom).

Task avoidance refers to simply avoiding the task (or a specific aspect of a task) that is affecting one’s emotions. Students reported doing this approximately 6% of the time overall and very rarely for regulating anxiety. Examples of task avoidance include the following:

- ‘I changed the subject I was studying’ (P64, Time 1, Boredom).
- ‘I went to play computer games to change the feeling of boredom’ (P112, Time 2, Boredom).
- ‘I tried to focus on the questions that I did know and I tried to come back to it when I thought I could understand it better’ (P155, Time 1, Anger).

Cognitive change was one of Gross’s (1998) categories and represents strategies to alter thinking or perceptions related to the task. Students often made statements about thinking positively about the task or thinking about the value or importance of the task. Students reported using these strategies about the same amount as task avoidance strategies, and they appeared to use them more often for regulating anxiety, especially compared to boredom. Examples include the following:

- ‘The next night, I looked at the little part of the essay that I had gotten done and that made me force myself to think realistically about my schoolwork. I had realized that school is the most important thing for me at this point and that time is valuable’ (P69, Time 3, Shame).
- ‘I had a test on the chapters the next day so I needed to continually remind myself of the chapters’ importance’ (P165, Time 3, Boredom).

- 'I knew it was an important lab, and that I would learn a lot that would be useful all through university, so I tried to think of it as important, not meaningless, which it sometimes seemed' (P145, Time 1, Boredom).

Response modulation, another of Gross's (1998) categories, includes attempts to directly change an emotion, such as taking deep breaths or trying to relax or calm down. These strategies were reported approximately 5% overall. Similar to cognitive change, these strategies were reported more often for regulating anxiety compared with regulating boredom. Examples of response modulation include the following:

- 'While writing the test I attempted to calm myself by taking a deep breath and literally telling myself to calm down' (P121, Time 1, Anxiety).
- 'I tried to get more sleep and rest at the appropriate times so that I was less tired and was more attentive' (P105, Time 2, Other negative).
- 'To get something to eat because am usually mad when am hungry' (P149, Time 3, Anger).

Do nothing included reports by students that they did nothing to change their emotions, sometimes indicating that the emotion was beneficial. Doing nothing was reported a bit more often for regulating boredom than anxiety. Students wrote the following statements:

- 'I didn't really try anything to change this feeling. Perhaps I should've searched some methods in which I could've limited the amount of stress I was under,' (P160, Time 3, Anger).
- 'I didn't try and change the feelings. I accepted what had happened and moved on,' (P167, Time 2, Anger).

- ‘Honestly, I didn't do anything, it helped me finish faster’ (P70, Time 3, Boredom).

Environment management strategies were reported least frequently overall and were used most often in the face of boredom. These strategies involve altering the environment, such as studying in a different location or changing something within the environment. Students often reported using these methods to reduce or eliminate distractions. For example, students wrote the following:

- ‘Closed the door and tried to ignore what was going on outside. Turned off my computer and put my cell phone away, somewhere where it wouldn't distract me’ (P157, Time 1, Boredom).
- ‘I dealt with my jammed printer, and found that it relieved some of my stress once I had fixed it’ (P71, Time 3, Anxiety).
- ‘Listening to some music while writing the paper’ (P76, Time 2, Boredom).

Patterns of intra-individual strategy use

After describing the types of strategies students reported using and the frequency of strategy use over time, we followed this up by examining whether students tended to use the same or a different strategy to regulate their emotions from one study session to the next. Table 9 displays the number of students who reported using the same or a different strategy from Time 1 to Time 2 and from Time 2 to Time 3 to address (a) the same emotional challenge or (b) a different emotional challenge. As can be seen, students more frequently reported using a different type of strategy rather than the same type of strategy from one time to the next regardless of whether or not they reported the same or a different emotion. Chi-square tests in which the expected frequencies were set at 50% for reporting the same strategy and for reporting a different strategy

confirmed this observation (see Table 9; see Preacher, 2001, for software used to perform the tests).

Table 8. Number of students reporting the same or a different type of emotion regulation strategy from one time to the next.

Time period	Same emotion				Different emotion			
	Same strategy <i>n</i>	Different strategy <i>n</i>	χ^2	<i>p</i>	Same strategy <i>n</i>	Different strategy <i>n</i>	χ^2	<i>p</i>
Time 1 to Time 2	7	30	14.30	<.001	9	48	26.68	<.001
Time 2 to Time 3	10	21	3.90	.048	12	46	19.93	<.001
Total	17	51			21	94		

Discussion

Positive and negative emotions generally predict students' self-evaluations of goal attainment

Our findings generally supported our hypotheses about the relation between emotions and self-evaluations of goal attainment. Overall, we found that the intensity of positive emotions positively predicted self-evaluations of goal attainment and the intensity of negative emotions negatively predicted self-evaluations of goal attainment. This finding could be interpreted in at least three different ways. One interpretation is that students' emotions were acting as conditions during task enactment, influencing motivation and strategy use and resulting in higher or lower levels of goal attainment (Winne & Hadwin, 1998, 2008). A second interpretation is that emotions were acting as products during task enactment, reflecting perceptions of goal progress (Carver & Scheier, 1990, 2000; Winne & Hadwin, 1998, 2008). However, as products or signals

of goal progress, these emotions may have then served as conditions, ultimately influencing goal attainment. Because students did not indicate how they were feeling and rate their goal progress throughout the study session, it is difficult to determine the exact role of students' emotions during studying.

Finally, a third interpretation is that students' self-evaluations of goal attainment influenced their memories of emotional experience. It is plausible that prompting students to first rate their goal attainment in the PPT could have biased their memories for the emotions they experienced. For example, if a student remembered fully attaining his goal from the previous week, he may have recalled more positive and less negative emotions associated with that goal, regardless of whether or not he actually felt that way when engaged in the task. However, even if students' reports in the PPT were not accurate, their beliefs about how they felt may have influenced subsequent actions (e.g., Robinson & Clore, 2002). As an example, if a student recalls a negative experience in last week's study session, she may be less confident and less motivated to engage in this week's study session. Future research could examine the relation between emotions in one study session and students' efficacy for achieving their goal as well as their ratings of goal attainment in the next study session.

Positive emotions are important to consider in an educational context

Although much of the past research has focused on negative emotions, the finding that positive emotions had the biggest effect in the prediction of self-evaluations of goal attainment supports other researchers' perspectives that positive emotions are important to consider (Fredrickson, 1998, 2001; Pekrun et al., 2002). Further research should help elucidate the role of positive emotions. In the current study, students were asked to choose one emotion that negatively affected their goal progress, but in the future students might instead be asked to select an

emotion that positively affected their goal progress and describe how they could maintain or achieve that effect at another time. It may be that students could benefit from strategies that help to increase desirable emotions in addition to strategies that help to decrease undesirable emotions.

Boredom appears to be a unique emotion in undergraduate studying

Boredom was a predominantly selected emotional challenge, supporting other research demonstrating the prevalence of this emotion (e.g., Nett et al., 2011). However, we did not find that boredom was associated with lower goal attainment, which was surprising considering other studies have shown that boredom is associated with negative outcomes (e.g., Ainley, Corrigan, & Richardson, 2005; Daniels et al., 2009; Pekrun et al., 2009; Pekrun et al., 2010). Similar to our study, Pekrun et al. (2010, Study 2) used a subjective measure of progress, but in contrast to our study, they found a negative relation with boredom. However, the participants in Pekrun et al.'s (2010) study completed the measures while studying, whereas the participants in our study completed the measures up to one week after studying. The difference in timing of measurement may help to explain the discrepancy in findings. In other words, perhaps students' actual experiences of boredom are more closely related to their perceptions of progress than are their memories about their experiences of boredom.

Alternatively, it could be that students in our sample were more proficient at counteracting boredom due to taking a course aimed at improving students' skills in SRL. Although students do not formally learn about regulating motivation and emotions until the end of the course, they are introduced to SRL processes (e.g., goal setting) and a variety of cognitive strategies (e.g., concept mapping) throughout the semester that may be appropriate for effectively managing boredom while studying. In addition, it is possible the strategies students

reported using to regulate their emotions, such as taking breaks, focusing on the task, and changing strategies were more effective for managing boredom than other emotions. These explanations might account for why students' mean level of boredom across study sessions positively—rather than negatively—predicted goal attainment. Clearly, further research is needed to better understand the role of boredom in students' self-regulated studying.

Students report using a variety of strategies to regulate their emotions while studying

Pekrun and Linnenbrink-Garcia (2012) note there exists little empirical research on the regulation of emotions beyond test-related emotions. This study has offered some evidence to fill this gap by examining the types of strategies students report using to regulate their emotions during their day-to-day studying. Although we initially used Gross's (1998) five categories of emotion regulation to code students' strategies, we found it was necessary to further differentiate among the categories in order to reflect the context-specific nature of students' methods for managing their emotions while engaged in their goal-directed academic activities. Table 9 displays how our categories might fit within Gross's framework as well as two other frameworks that describe how students regulate during academic activities. The framework described by Schutz and colleagues (Schutz & Davis, 2000; Schutz et al., 2004) contains four dimensions of emotion regulation specifically during test-taking (cognitive-appraising processes, task-focusing processes, regaining task-focus processes, and emotion-focusing processes). We also show how our categories might align with the categories for regulating motivation described by Wolters' (1998, 2003), which come from research both on motivation regulation specifically and on self-regulation strategies in general (e.g., Purdie & Hattie, 1996; Zimmerman & Martinez-Pons, 1986, 1988).

Table 9. Possible classification of strategies in existing frameworks of emotion and motivation regulation.

Strategy category in current study	Strategy category in existing frameworks		
	Process model of emotion regulation (Gross, 1998)	Emotion regulation during test-taking (Schutz & Davis, 2000; Schutz et al., 2004)	Motivation regulation (Wolters, 1998, 2003)
Task/goal management	Situation selection; situation modification	Task-focusing	Environmental structuring; proximal goal setting
Task focus	Attentional deployment	Task-focusing	Willpower
Task enactment	Attentional deployment; situation modification	Task-focusing	Cognition; task value; interest
Self-consequating thoughts/actions	Attentional deployment		Self-consequating
Social support	Situation selection; situation modification		Help-seeking
Enhancing competence	Attentional deployment		
Task avoidance	Attentional deployment; situation selection	Emotion-focusing	Self-handicapping
Cognitive change	Cognitive change	Cognitive-appraising; task-focusing; regaining task-focus	Emotion regulation; task value
Response modulation	Response modulation	Regaining task-focus	Emotion regulation
Do nothing			
Environment management	Situation selection; situation modification		Environmental structuring

Table 9 reveals that our strategies most closely align with the motivation regulation strategies described by Wolters (1998, 2003). This may not be surprising because emotion has

been identified as an integral component of motivation (e.g., Ford, 1992; Meyer & Turner; 2002, 2006) and, hence, may be regulated in similar ways to motivation. Furthermore, the most frequently reported emotional challenge was boredom, so it is easy to imagine that students were engaging strategies to enhance their motivation in what they considered to be a boring task. On the other hand, it was difficult to classify several of our strategies along the dimensions of emotion regulation during test-taking proposed by Schutz and colleagues (Schutz & Davis, 2000; Schutz et al., 2004). This is also not unexpected as students likely have a wider range of techniques to choose from during day-to-day studying as compared to a fairly restricted context such as taking a test. Because of the similarities between our strategies and the motivation regulation strategies described by Wolters's (1998, 2003), it may be worthwhile to further explore the distinction between regulating emotions and regulating motivation during goal-directed, independent studying. Perhaps an integrated framework could be developed from this research, or perhaps it will be discovered that there are indeed differences between these two areas that call for separate frameworks.

Examining the frequency of strategies reported by students reveals one particularly interesting finding. That is, the strategy of reappraisal, although often targeted in past research, was not a predominant response in the present investigation. This could be due to many reasons, such as (a) students may not have been aware of reappraisal as a strategy, (b) students may have lacked the skills and practice for implementing it, or (c) students may have used the strategy in the past, but did not find it effective. This warrants further investigation into the reasons why students choose or do not choose to use particular strategies.

Finally, we also conducted a preliminary examination of strategy use by individual students over time and found that students more often switched to a different strategy rather than

using the same strategy from one study session to the next. One interpretation of this finding is that students were engaging in self-regulatory actions by experimenting with different emotion regulation strategies. In order to self-regulate, students need to be willing to change and adapt their strategies to optimize their own goal attainment both within the same task and across tasks and studying episodes. On the other hand, this pattern of changing strategy use may indicate that students are struggling to find strategies that work, suggesting that they might need support to choose appropriate strategies. Furthermore, it is important to note that students who reported using the same type of strategy from one time to the next were not necessarily engaging in maladaptive regulation as they may have been strategically selecting a strategy that was effective in a past study session. To understand these issues in more depth, future research should examine the perceived effectiveness of strategies students employ to regulate emotional challenges as well as the reasons why students choose specific strategies.

Challenges to be addressed in researching emotion regulation during studying

Challenges in measuring emotions plague the field. It has been argued that stopping to report on emotions may interfere with the experience itself (Schutz, Hong, Cross, & Osbon, 2006), while retrospective self-reports of emotions may distort them. This study relied on students' retrospective self-reports of what occurred during the previous week's studying. On the one hand, retrospective perceptions of what occurred while working on a previous task might influence subsequent actions in a future task. On the other hand, human memory is fallible. Emotions are something felt in the moment, and it is possible that delayed recollection of emotions actually distorts the nature or intensity of the emotion. Following recommendations by other researchers (e.g., Op 't Eynde & Turner, 2006; Schmitz & Wiese, 2006), future research might include real-time tracking of emotions using methods that allow for quick, unobtrusive

responses. For example, rather than having students go through a list of emotions and rate the intensity, they could simply choose the predominant emotion they are feeling.

Another challenge that has emerged from this study pertains to the treatment of students' emotion reports in analysis. In particular, we found that boredom did not fit with the other emotions when creating our scales. Although our final scales demonstrated acceptable reliability, it is possible that examining discrete emotions would reveal differing relations with self-evaluations of goal attainment. Indeed, Pekrun, Elliot, and Maier (2006) suggest that inconsistent findings in research on achievement goals and affect may be due to combining different emotions into single measures of positive and negative affect. Given the sample size in our study, it is likely we would have no power to detect statistically significant relations if we included each emotion as a separate predictor; in the future, however, it may be worthwhile to further explore the relations among discrete emotions and self-evaluations of goal attainment.

Conclusion

This study has been an important foundational step in a program of research and practice that may help students to attain greater academic success and persist in their education. Instruments used in this study have provided valuable information about (a) connections between emotions and self-evaluations (a key self-regulatory construct), (b) types of strategies students report using to regulate emotions that may be interfering with progress during studying, and (c) patterns of strategy use for regulating emotions over time. The data in this study consisted of real-life examples of strategies students use to address emotional challenges while studying. With further research in this area, these data might be used to develop instructional modules for students to help them strategically regulate their emotions as well as self-regulate their learning. Designing academic environments that are amenable to desirable emotions may be one aim for educational

research and practice (e.g., Pekrun & Linnenbrink-Garcia, 2012); however, coupled with this should be the aim of helping students develop the necessary skills to regulate their own emotions so they are better equipped to face the challenges that may be present in a variety of contexts, both in an academic setting and beyond.

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