



Positive academic emotions moderate the relationship between self-regulation and academic achievement

Felicidad T. Villavicencio^{1,2*} and Allan B. I. Bernardo^{2*}

¹Bulacan State University College of Social Sciences and Philosophy, Bulacan, Philippines

²De La Salle University, Manila, Philippines

Background. Research has shown how academic emotions are related to achievement and to cognitive/motivational variables that promote achievement. Mediated models have been proposed to account for the relationships among academic emotions, cognitive/motivational variables, and achievement, and research has supported such mediated models, particularly with negative emotions.

Aims. The study tested the hypotheses: (1) self-regulation and the positive academic emotions of enjoyment and pride are positive predictors of achievement; and (2) enjoyment and pride both moderate the relationship between self-regulation and achievement.

Sample. Participants were 1,345 students enrolled in various trigonometry classes in one university.

Methods. Participants answered the Academic Emotions Questionnaire-Math (Pekrun, Goetz, & Frenzel, 2005) and a self-regulation scale (Pintrich, Smith, Garcia, & McKeachie, 1991) halfway through their trigonometry class. The students' final grades in the course were regressed to self-regulation, positive emotions, and the interaction terms to test the moderation effects.

Results and Conclusions. Enjoyment and pride were both positive predictors of grades; more importantly, both moderated the relationship between self-regulation and grades. For students who report higher levels of both positive emotions, self-regulation was positively associated with grades. However, for those who report lower levels of pride, self-regulation was not related to grades; and, for those who reported lower levels of enjoyment, self-regulation was negatively related to grades. The results are discussed in terms of how positive emotions indicate positive appraisals of task/outcome value, and thus enhance the positive links between cognitive/motivational variables and learning.

Research has shown that academic emotions influence students' learning and achievement. This influence has been demonstrated in relation to students' motivation.

*Correspondence should be addressed to Felicidad T. Villavicencio, Bulacan State University College of Social Sciences and Philosophy, Guinhawa, Malolos City, Bulacan 3000, Philippines (e-mail: felicidad.villavicencio@yahoo.com) or Allan B. I. Bernardo, De La Salle University, 2401 Taft Avenue, Manila 1004, Philippines (e-mail: allanbbernardo@yahoo.com; allan.bernardo@dlsu.edu.ph).

For example, learners are more willing to invest their effort and time if learning activities are enjoyable and interesting rather than anxiety laden or boredom inducing (Frenzel, Pekrun, & Goetz, 2007a). Emotions also induce and sustain student interest in learning material (Ainley, Corrigan, & Richardson, 2005; Krapp, 2005). But emotions also influence the more cognitive aspects of learning, as they can trigger different modes of information processing and problem solving (Isen, 1999), and facilitate or impede students' self-regulation of learning (Pekrun, Goetz, Titz, & Perry, 2002). In the present study, we will show that academic emotions also moderate the positive influence of self-regulation on academic performance. In particular, we will show how two positive academic emotions, enjoyment and pride, enhance the positive relationship between students' self-regulation and their academic performance in trigonometry.

Academic emotions and achievement: cognitive–motivational model

Pekrun's (1992) cognitive and motivational model (which is a component of his broader control-value theory of academic emotions, see Pekrun, 2000, 2006) postulates that the influence of academic emotions on achievement is associated with cognitive and motivational mechanisms (cognitive resources, learning motivation, learning strategies). Positive emotions such as enjoyment, hope, and pride likely have a positive influence on motivation, the use of flexible learning strategies and self-regulation, and the availability of cognitive resources for task engagement (Pekrun *et al.*, 2002). In contrast, negative emotions impair motivation and trigger the use of more rigid strategies, such as simple rehearsal and algorithmic procedures. In particular, negative emotions such as anger, anxiety, and boredom are thought to reduce cognitive resources and self-regulation (Pekrun, 1992; Pekrun *et al.*, 2002).

The relationship between academic emotions and these motivational and cognitive learning variables has been well established in research. Recent studies have shown how positive emotions are related to a range of motivation related variables such as competency beliefs, task and achievement value (Frenzel *et al.*, 2007a), learning goals (Roeser, Midgley, & Urdan, 1996), mastery and performance approach goals (Pekrun, Elliot, & Maier, 2006, 2009), intrinsic motivation (Ouano, 2011), study interest, effort, more complex learning strategies, and self-regulation (Titz, 2001, cited in Pekrun *et al.*, 2002). The same studies also report the negative impact of negative emotions on the same variables, but in addition, other studies have also documented the negative mediating effect of negative emotions on the relationship between mastery goals and working memory (Linnenbrink, Ryan, & Pintrich, 1999), on the relationship between critical thinking and achievement (Villavicencio, 2011), among others.

Pekrun's (1992) cognitive–motivational model assumes that the effect of academic emotions on achievement is mediated by the motivational and cognitive variables. Pekrun and colleagues wrote: 'it is assumed that the effects of emotions on learning and achievement are mediated by a number of cognitive and motivational mechanisms' (Pekrun *et al.*, 2002, p. 97). Yet some studies have defined academic emotions as mediating variables in the relationship between motivational (Pekrun *et al.*, 2006, 2009; Roeser *et al.*, 1996) and cognitive variables (Villavicencio, 2011) and academic achievement. The varying roles of academic emotions in predictions of achievement can be understood in relation to the reciprocal causation in the control-value theory of academic emotions (Pekrun, 2006; Pekrun *et al.*, 2002). As emotions are assumed to

have an influence on the learning and achievement of students, the students' success or failure in learning also influences their appraisals and emotions. The reciprocal causation can involve either positive or negative feedback loops that take place over time, and may result in changes in the academic emotions over time. However, the theory also suggests that appraisal processes can be automatized and schematized over time, especially with repeated learning experiences resulting in fairly similar outcomes (Pekrun *et al.*, 2006; Resenkein, 2001).

The current study

In this study, we propose that academic emotions do not only play a role in mediational models relating motivational and cognitive variables to student learning. We propose that academic emotions can also moderate the relationships among cognitive and motivational variables and student learning and achievement. In the current investigation, we propose that positive emotions can enhance the positive relationship between self-regulation and achievement. The moderating role of academic emotions has been demonstrated only once previously by Ruthig *et al.* (2008) who found that negative emotions buffered the benefits of high control on achievement, while positive emotions enhanced the same benefits. In this study, we aim to provide further evidence regarding how academic emotions interact with cognitive-motivational variables by focusing on the relationship between self-regulation and achievement.

Self-regulation refers to 'self-generated thoughts, feelings, and actions that are planned and systematically adapted as needed to affect one's learning and motivation' (Schunk & Ertmer, 2000, p. 631). In order to contrast self-regulation with external regulation, scholars such as Pintrich (2003) describe self-regulation as an active and constructive process where the learner him/herself defines the goals of the learning tasks, and also monitors, regulates, and controls the cognitive and motivational processes towards attaining the goals. Boekaerts and Corno (2005) underscore the complex interaction between (meta)cognitive and motivational aspects of self-regulation, such that the learner also ensures that engaging the learning task does not result in too much distortion in the student's well-being.

There is considerable research indicating that the use of self-regulatory strategies improves learning and achievement (Zimmerman, 2002, 2008). Moreover, research has also shown how self-regulation is related to academic emotions in predicted (i.e., positive and negative) ways (Titz, 2001, cited in Pekrun *et al.*, 2002). Drawing from the findings of these related studies, we predict that self-regulation would be positively associated with positive emotions, and also with achievement. Moreover, we hypothesize that positive emotions would enhance the positive relationship between self-regulation and achievement. We base this hypothesis on assumptions of control-value theory of academic emotions (Pekrun, 2000, 2006), which incorporate assumptions of expectancy-value theory (Graham & Weiner, 1996; Weiner, 1985). We assumed the positive emotions would indicate a positive appraisal of the value of the task and/or the achievement outcomes, and as such positive emotions should enhance the cognitive and motivational processes inherent in self-regulation. Thus, students who are self-regulating and who experience enjoyment and pride during the learning task are likely to value both the task and the outcomes, and are thus more likely to attain higher levels of learning achievement due to their self-regulation. On the other hand, self-regulating students who do not experience enjoyment and pride in the task are probably not valuing the

task and the outcomes. In this case, self-regulation should still lead achievement, but not in the same levels as with the students who are feeling enjoyment and pride in their tasks.

Corresponding predictions could be made regarding the moderating effect of negative emotions. However, in this study, we chose to focus only on positive emotions specifically because the impact of positive emotions is often neglected in educational research (Fredrickson, 2001; Pekrun *et al.*, 2002), which has tended to focus on the negative emotions such as anxiety.

In summary, in this study, we aim to show that the positive academic emotions of enjoyment and pride enhance the positive effects of self-regulation on achievement. We test this proposition with a sample of Filipino university students studying trigonometry. We predict that self-regulation, enjoyment, and pride would be positively associated with the students' achievement in trigonometry measured by their grade in the course. Self-regulation should also be positively related to the two positive emotions. Finally, we predict that the positive effect of self-regulation on achievement will be moderated by each of the two positive emotions.

Method

Participants

Participants were 1,345 first year university students enrolled in various trigonometry subjects in a state university in the Philippines. Their ages ranged from 15 to 25 years ($M = 16.49$; $SD = 1.66$), and most were male (67.4%). All participants gave their informed consent to participate in the study and allow researchers to access their final grade for the course.

Measures

All participants responded to the Self-Regulation Scale, and the Academic Emotions Questionnaire after the midterm examination of the students, during the eighth week of the semester. All the instruments include contextualized items pertaining to trigonometry. These contextualized items impose a specific frame of reference (e.g., '*I enjoy my trigonometry class*' and '*It is my own fault if I don't learn in trigonometry*') on participants when responding to emotion and self-regulation items.

Academic emotions

The students' positive emotions of enjoyment and pride were assessed using the Achievement Emotions Questionnaire-Math (AEQ-M; Pekrun, Goetz, & Frenzel, 2005). The items in the AEQ-M referred to emotional experiences such as class-related, learning-related, and test-related emotion items that specifically referred to their trigonometry class. There are 60 items referring to eight different academic emotions in the AEQ-M, but for this study, only the items in the enjoyment (10 items, e.g., '*I enjoy trigonometry so much that I am strongly motivated to participate*') and pride (six items, e.g., '*I am proud of how well I have done on the trigonometry test*') scales were analysed. Participants were asked to indicate their agreement with each item using a 5-point scale (1 = *strongly disagree*; 5 = *strongly agree*). Both scales have adequate internal consistency (enjoyment: Cronbach $\alpha = .75$, pride: $\alpha = .87$).

Self-regulation

Self-regulation was measured using the self-regulation subscale of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). The scale consists of 14 items that all referred to acts that indicate self-regulation, which were contextualized to the trigonometry subject (e.g., 'When I become confused about something I'm reading in trigonometry, I go back and try to figure it out'). Participants were asked to indicate how true the items were for their experience in the trigonometry class they were currently taking using 5-point scale (1 = *not at all true of me*; 5 = *very true of me*). The scale also had adequate internal consistency ($\alpha = .76$).

Achievement

The students' achievement in trigonometry was assessed using their final grades in their trigonometry classes, which were obtained eight weeks after the students answered the other questionnaires. The grades were determined by considering a wide array of assessment tools (such as, long exams, quizzes, class participation, etc.) and range from 1.0 (highest) to 5.0 (lowest), where 3.0 is the passing mark. To simplify the interpretation of results, these grades were converted such that higher values indicated higher achievement.

Results

Descriptive statistics

The descriptive statistics for the various variables are summarized in Table 1. The expected positive relationship between self-regulation and achievement, and between the positive emotions and achievement were confirmed. The expected relationships between self-regulation and each of the two positive emotions were also confirmed.

Moderating effects of positive emotions

To test the predicted moderating effects, two hierarchical multiple regression analyses were conducted: (1) testing the moderating effect of enjoyment on the relationship between self-regulation and the final grades, and (2) testing the moderating effect of pride on the relationship between self-regulation and final grades. For each hierarchical moderated regression analysis, the predictor (self-regulation) and moderator

Table 1. Descriptive statistics for the variables

	M	SD	Correlations (<i>r</i>)		
			(2)	(3)	(4)
(1) Self-regulation	3.51	.55	.60*	.57*	.22*
(2) Enjoyment	3.55	.68	–	.81*	.37*
(3) Pride	3.60	.83		–	.25*
(4) Final grade	1.66	.56			–

Note. For all variables, higher scores indicate higher levels of the variables; * $p < .001$.

Table 2. Moderating effects of enjoyment on self-regulation and final grade

Variable	Final grade				Variable	Final grade			
	Step 1		Step 2			Step 1		Step 2	
	β	Standard error β	β	Standard error β		β	Standard error β	β	Standard error β
Self-regulation	-.01	.03	.02	.03	Self-regulation	.12***	.03	.14***	.03
Enjoyment	.30***	.03	.29***	.03	Pride	.12***	.02	.14***	.02
Self-regulation × Enjoyment			.21***	.03	Self-regulation × Pride			.21***	.02
Total R ²	.13***		.17***		Total R ²	.07***		.13***	
ΔR^2			.04***		ΔR^2			.06***	

Note. *** $p < .001$.

variable (enjoyment or pride) were entered at Step 1. The interaction term (e.g., self-regulation × enjoyment) was entered in Step 2. For this analysis, the scale scores for self-regulation, enjoyment, and pride were centred by subtracting each score from the variable mean to reduce multicollinearity between the main effect and the interaction terms, and to ensure that the interpretation of the effects would occur at a meaningful value (Cohen, Cohen, West, & Aiken, 2003). The centred scores were then used to create the cross-product used as the interaction term in the regression analysis (Cohen *et al.*, 2003; Frazier, Tix, & Barron, 2004; Whisman & McClelland, 2007).

Moderating effects of enjoyment on self-regulation and final grade

In Step 1, final grade was regressed to self-regulation and enjoyment, and the variables accounted for 13% of the variance $\Delta F(2, 1342) = 104.08, p < .001$. As shown in Table 2, the predicted relationship between self-regulation and final grades was not found; but as expected, enjoyment positively predicted achievement. Note that the non-significant relationship between self-regulation and final grades does not indicate that the hypothesized moderating effects of emotions are disconfirmed. Moderators may or may not be related to the predictor or criterion, and the predictor may or may not be related to the criterion (Frazier *et al.*, 2004), and thus, tests for the moderating effect of enjoyment were still conducted.

In Step 2, the interaction term for self-regulation and enjoyment was entered, and the variables accounted for 17% of the variance $\Delta F(1, 1341) = 104.08, p < .001$. Again, self-regulation did not predict final grades, and enjoyment positively predicted achievement. The interaction term was significant (see Table 2). To examine the interaction effect, simple slopes were evaluated using the graphing procedure for interactions recommended by Cohen *et al.* (2003) in which all values were first converted to z scores. Representative points (low and high) on the moderator variable (enjoyment or pride) regression lines were then predicted for high and low levels of the self-regulation. The predicted values were then obtained and then plotted following the procedure outlined by Frazier *et al.* (2004). This interaction is shown in Figure 1. For students who reported high level of enjoyment, final grades were higher for those who reported higher levels of self-regulation. In contrast, for students who reported low levels of enjoyment, final grades were actually lower for those who reported higher levels of self-regulation.

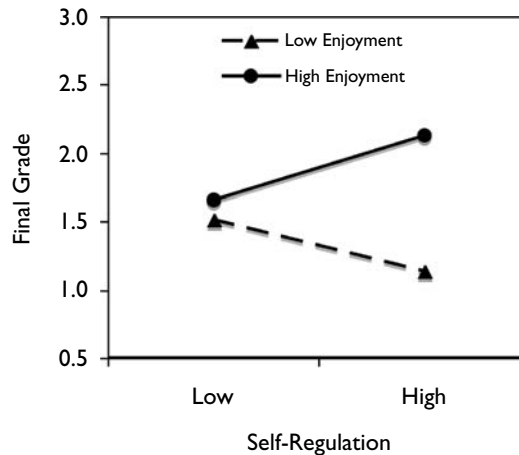


Figure 1. Significant interaction effect of self-regulation and enjoyment when predicting final grades.

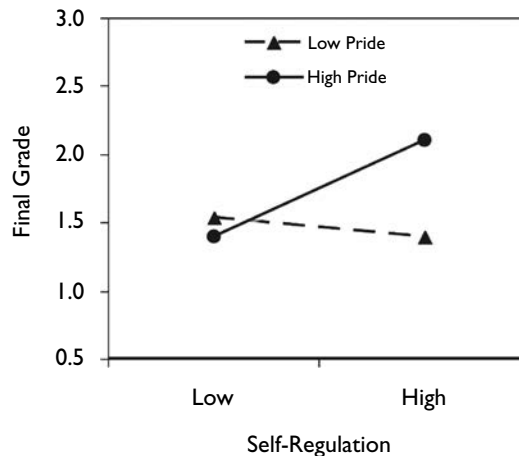


Figure 2. Significant interaction effect of self-regulation and pride when predicting final grades.

The interaction effect actually explains why there was no main effect of self-regulation on final grades, as there was actually a negative relationship between self-regulation and final grades for the students who reported low enjoyment in their classes.

Moderating effects of pride on self-regulation and final grades

In Step 1, self-regulation and pride accounted for 7% of the variance $\Delta F(2, 1342) = 51.78$, $p < .001$. In this case, both self-regulation and pride predicted achievement (see Table 2). In Step 2, the addition of the interaction term for self-regulation and pride accounted for 13% of the variance $\Delta F(1, 1341) = 85.57$, $p < .001$. Self-regulation predicted final grades and so did pride. The interaction term was significant, and this interaction is shown in Figure 2. For students who reported high level of pride, final grades were higher for those who reported higher levels of self-regulation. In contrast, for students who

reported low levels of pride, there seems to be no relationship between self-regulation and final grades.

Discussion

The present study was conducted to demonstrate how positive emotions could enhance the positive relationship between self-regulation and students' achievement. Previous research has consistently shown the positive links between self-regulation and student learning and achievement, and there is also evidence for the positive link between self-regulation and positive academic emotions. The results of the study show that the experience of enjoyment and pride moderates the positive consequences of self-regulation on achievement.

Before we discuss specific aspects of the results and their implications, we would like to acknowledge some limitations of the study. One limitation relates to the use of self-reports to assess students' self-regulation. Previous research (Samuelstuen & Braten, 2007; Winne & Jamieson-Noel, 2002) has pointed to some problems with students' assessment of their own strategic processes during learning tasks, and thus relying solely on self-reports of assessment, even if the self-report measure is a very well-established tool in the literature, may not be the ideal approach to studying students' self-regulatory behaviours, and is thus an important limitation of the current study. Future research should be undertaken to validate the same interactive relationship between self-regulation and academic emotions using more direct, and if possible, multiple convergent measures of self-regulatory behaviours of students.

A similar limitation of the study relates to the use of self-reports to study students' academic emotions. We also acknowledge that self-reports may not be the most reliable measure of emotions, and there have been previous concerns about whether the concept of academic emotions actually means the same thing across cultures (Bernardo, Ouano, & Salanga, 2009). However, we wish to underscore that there is considerable work done to validate the different versions of the Academic Emotions Questionnaire (Frenzel *et al.*, 2007a; Pekrun *et al.*, 2002, 2006), and the validity of the scale is demonstrated across the sexes (Frenzel, Pekrun, & Goetz, 2007b) and also cross-culturally (Frenzel, Thrash, Pekrun, & Goetz, 2007; King, 2010). Thus, we believe that the AEQ-M we used in the study, although perhaps not the ideal measure of emotions, is known to be a reliable and valid measure of academic emotions.

Consistent with the theoretical assumption of reciprocal causation (Pekrun, 2006; Pekrun *et al.*, 2002), emotions are conceived to be dynamically changing over the time course of learning, as it is shaped by the various activities and outcomes in class. Our study took a snapshot of the students' academic emotions somewhere in the middle of the term, and related this snapshot to their achievement at the end of the course. As such, we are unable to sufficiently track how the experience of enjoyment and pride at the midpoint of the course moderates the positive relationship between self-regulation and achievement outcomes, and this is a limitation of our study. In this regard, Pekrun (2006) has noted the need to develop better measures that would allow for the measure and analysis of emotional processes over time. We see the value of doing longitudinal studies and/or more sophisticated modelling techniques to more clearly elucidate the dynamic and reciprocal relationships among positive academic emotions, self-regulation, and achievement.

However, by choosing to study the moderating effect of positive emotions in this cross-sectional manner, we believe that we are still able to demonstrate how influential the experience of positive emotions at a single point in time can be over the effects of self-regulatory behaviours on student achievement. Although we do not presume that the snapshot of the academic emotions represents the total positive emotional experience of the students throughout the course, we would like to think that by demonstrating the moderating effect of a cross-sectional measure of their positive academic emotions, we provide clear indications of how important these enhancing effects of positive academic emotions might be.

As the results of the two moderation analyses show, the experience of high levels of both positive emotions was associated with gains in the final grades as a function of increases in self-regulation. We should underscore that there has been very little evidence about the moderating effect of academic emotions on the relationship between cognitive-motivational variables on the one hand and learning and achievement on the other. We found only Ruthig *et al.*'s (2008) study of the interaction between academic emotions and control appraisals as providing evidence for such a moderating effect. Our results are quite consistent with their findings, and we see our results as supporting the theoretical argument that the moderating effect of academic emotions relates to assumptions of value-expectancy theories of motivation and learning (Graham & Weiner, 1996; Weiner, 1985) as this is adapted within the control-value theory (Pekrun, 2006). In particular, we believe that positive emotions indicate a positive appraisal of the value of the learning task and/or the outcomes of the learning tasks. Thus, high self-reported levels of the positive emotions should reinforce the learners' sense of control over the learning situation, and thus intensify the benefits of self-regulation. Consistent with this point, Tracy and Robins (2004) asserted that pride can motivate efforts aimed at developing a difficult skill. Pekrun *et al.* (2002) likewise report on how enjoyment during learning tasks is associated with more interest and effort in learning, and less irrelevant thinking, all of which indicate positive appraisals of the learning task, which would support self-regulation in learning.

In contrast, low self-reported levels of the positive emotions may indicate negative task value and/or outcome value appraisals, which might undermine the hypothesized positive effects of self-regulation on learning and achievement. We found good evidence for this point in our moderation analysis. In the case of students who reported lower levels of pride, self-regulation seemed to be unrelated to the final grades. More interestingly, for the students who reported lower levels of enjoyment, self-regulation was actually negatively related to the final grade. The difference in these patterns may relate to some fundamental difference between pride and enjoyment. Enjoyment is an academic emotion related to the process of learning, whereas pride is a retrospective emotion that relates to some previous outcomes of learning processes. Thus, a student who reported low levels of pride has probably obtained less than ideal outcomes in the first half of the course. This student may have already negatively appraised the value of the learning task and outcomes, and the low level of the pride is just sustained throughout the course. On the other hand, because enjoyment is a process-related emotion, it is possible that low enjoyment at halfway through the course would have negative consequences on achievement outcomes at that point, which would then exacerbate the low levels of enjoyment, particularly for students who are highly self-regulating. At the end of the term, the cumulative effect of these low levels of enjoyment associated with constant effortful self-regulating would lead to decreasing achievement.

Related to this point, we would like to note that in one of the specific analyses, the positive relationship between self-regulation and achievement was not found. This was the case in the analysis of the moderating effects of enjoyment. It turns out that when enjoyment was included in the same set of predictors as self-regulation, the positive influence of self-regulation was not obtained because of the negative relationship between self-regulation and achievement among those who were not enjoying the task. Thus, what we assumed was a very robust effect in the research literature (Pintrich, 2003; Zimmerman, 2002, 2008) may need to be qualified, as these effects can be undermined by the experience of low levels of positive emotions. Indeed, the results of our two moderation analyses can be interpreted as suggesting that the positive relationship between self-regulation on student learning is actually contingent on the student's experiencing positive emotions during the learning activities. The experience of positive emotions may be a necessary condition for the positive relationship between self-regulation and achievement to be obtained.

We focused on positive emotions only in this study, to underscore the importance of positive emotional experience in the learning activities of students. We did so knowing that a full understanding of the role of emotions on students' learning experience would require the study of both negative and positive emotional experiences. However, we agree with the assessment of previous researchers that psychologists may not have paid sufficient attention to positive emotions, in general (Fredrickson, 2001), and to positive academic emotions, in particular (Pekrun *et al.*, 2002). We believe that the results of our study do not only show how positive emotions not only increase the motivational and cognitive resources required for learning, thus providing further cross-cultural evidence for this proposition that has been verified in previous studies (Daniels, Stupnisky, Pekrun, Haynes, & Perry, 2009; Goetz, Hall, Frenzel, & Pekrun, 2006; Pekrun *et al.*, 2002). More importantly, our results show that positive emotions can actually enhance the positive relationship between these motivational and cognitive resources and achievement in learning, at least in the specific case of self-regulation. The moderating effect of positive emotions provides some elaborations on current theoretical proposals on the important role of positive emotions in students' learning (Ruthig *et al.*, 2008). We hope that these results would encourage other psychological researchers to give at least as much attention to positive academic emotions to complement the rather extensive previous research on negative academic emotions such as anxiety. We believe that we need more precise psychological models and theories about how positive emotions such as enjoyment and pride, but also hope, satisfaction, and even relief influence students' motivations, cognitions, and learning outcomes. These more precise theoretical constructions can serve as more useful guides for educators who aim to create the best possible learning environments within which students can attain the highest possible levels of learning.

Acknowledgements

This research was supported by a Faculty Development Grant and a Dissertation Grant awarded to the first author by the Commission on Higher Education, Philippines. Preparation of this paper was supported in part by a Fulbright Fellowship awarded to the second author.

References

- Ainley, M., Corrigan, M., & Richardson, N. (2005). Students, tasks, and emotions: Identifying the contribution of emotions to students' reading of popular culture and popular science texts. *Learning and Instruction, 15*, 433-447. doi: 10.1016/j.learninstruc.2005.07.011
- Bernardo, A. B. I., Ouano, J. A., & Salanga, M. G. C. (2009). What is an academic emotion? Insights from Filipino bilingual students' emotion words associated with learning. *Psychological Studies, 54*, 28-37. doi: 10.1007/s12646-009-0004-7
- Boekaerts, M., & Corno, L. (2005). Self-regulation in the classroom: A perspective on intervention and assessment. *Applied Psychology: International Review, 54*, 199-231. doi: 10.1111/j.1464-0597.2005.00205.x
- Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Mahwah, NJ: Erlbaum.
- Daniels, L., Stupnisky, R., Pekrun, R., Haynes, T., Perry, R. (2009). A longitudinal analysis of achievement goals: From affective antecedents to emotional effects and achievement outcomes. *Journal of Educational Psychology, 101*, 948-963. doi: 10.1037/a0016096
- Frazier, P. A., Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counselling psychology. *Journal of Counseling Psychology, 51*, 115-134. doi: 10.1037/0022-0167.51.2.157
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist, 56*, 218-226. doi: 10.1037/0003-066X.56.3.218
- Frenzel, A. C., Pekrun, R., & Goetz, T. (2007a). Perceived learning environment and students' emotional experiences: A multilevel analysis of mathematics classrooms. *Learning and Instruction, 17*, 478-493. doi: 10.1016/j.learninstruc.2007.09.001
- Frenzel, A. C., Pekrun, R., & Goetz, T. (2007b). Girls and mathematics—A “hopeless” issue? A control-value approach to gender differences in emotions towards mathematics. *European Journal of Psychology of Education, 26*, 497-514. doi: 10.1007/BF03173468
- Frenzel, A. C., Thrash, T. M., Pekrun, R., & Goetz, T. (2007). Achievement emotions in Germany and China: A cross-cultural validation of the Academic Emotions Questionnaire-Mathematics. *Journal of Cross-Cultural Psychology, 38*, 302-309. doi: 10.1037/a0013383
- Goetz, T., Hall, N. C., Frenzel, A. C., & Pekrun, R. (2006). A hierarchical conceptualization of enjoyment in students. *Learning and Instruction, 16*, 323-338. doi: 10.1016/j.learninstruc.2006.07.004
- Graham, S., & Weiner, B. (1996). Theories and principles of motivation. In D. C. Berliner & R. C. Calfree (Eds.), *Handbook of educational psychology* (pp. 63-84). New York: Prentice Hall.
- Isen, A. M. (1999). Positive affect. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 521-539). New York: Wiley.
- King, R. B. (2010). What do students feel in school and how do we measure them? Examining the psychometric properties of the S-AEQ-F. *Philippine Journal of Psychology, 43*, 161-176.
- Krapp, A. (2005). Basic needs and the development of interest and intrinsic motivational orientations. *Learning and Instruction, 15*, 381-395. doi: 10.1016/j.learninstruc.2005.07.007
- Linnenbrink, E. A., Ryan, A. M., & Pintrich, P. R. (1999). The role of goals and affect in working memory functioning. *Learning and Individual Differences, 11*, 213-230. doi: 10.1016/S1041-6080(00)80006-0
- Ouano, J. A. (2011). Motivational antecedents of academic emotions in Filipino college students. *The Asia-Pacific Education Researcher, 20*, 127-132.
- Pekrun, R. (1992). The impact of emotions on learning and achievement: Towards a theory of cognitive/motivational mediators. *Applied Psychology: An International Review, 41*, 359-376. doi: 10.1111/j.1464-0597.1992.tb00712.x
- Pekrun, R. (2000). A social-cognitive, control-value theory of achievement emotions. In J. Heckhausen (Ed.), *Motivational psychology of human development* (pp. 143-163). Oxford, UK: Elsevier.

- 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., Elliot, A., & Maier, M. A. (2006). Achievement goals and discrete achievement emotions: A theoretical model and prospective test. *Journal of Educational Psychology*, 98, 583–597. doi: 10.1037/0022-0663.98.3.583
- Pekrun, R., Elliot, A. J., & Maier, M. A. (2009). Achievement goals and achievement emotions: Testing a model of their joint relations with academic performance. *Journal of Educational Psychology*, 101(1), 115–135. doi: 10.1037/a0013383
- Pekrun, R., Goetz, T., & Frenzel, A. C. (2005). *Academic Emotions Questionnaire-Mathematics (AEQ-M) user's manual*. Department of Psychology, University of Munich.
- 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
- Pintrich, P. R. (2003). A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 95, 667–686. doi: 10.1037/0022-0663.95.4.667
- Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1991). *A manual for the use of the Motivated Strategies for Learning Questionnaire* (Tech. Rep. No. 91-B-004). Ann Arbor, MI: University of Michigan.
- Reisenzein, R. (2001). Appraisal processes conceptualized from a schema-theoretic perspective. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion* (pp. 187–201). Oxford, UK: Oxford University Press.
- Roeser, R., Midgley, C., & Urdan, R. (1996). Perceptions of the school psychological climate and early adolescents' self-appraisals and academic engagement. *Journal of Educational Psychology*, 88, 408–422.
- Ruthig, J. C., Perry, R. P., Hladkyj, S., Hall, N. C., Pekrun, R., & Chipperfield, J. G. (2008). Perceived control and emotions: Interactive effects on performance in achievement settings. *Social Psychology of Education*, 11, 161–180. doi: 10.1007/s11218-007-9040-0
- Samuelstuen, M. S., & Braten, I. (2007). Examining the validity of self-reports on scales measuring students' strategic processing. *British Journal of Educational Psychology*, 77, 351–378. doi: 10.1348/000709906X106147
- Schunk, D. H., & Ertmer, P. A. (2000). Self-regulation and academic learning: Self-efficacy enhancing interventions. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 631–650). San Diego, CA: Academic Press.
- Tracy, J. L., & Robins, R. W. (2004). Show your pride: Evidence for a discrete emotion expression. *Psychological Science*, 15, 194–197. doi: 10.1111/j0956-7976.2004.01503008.x
- Villavicencio, F. T. (2011). Critical thinking, negative academic emotions, and achievement: A mediational analysis. *The Asia-Pacific Education Researcher*, 20, 118–126.
- Weiner, B. (1985). An attributional theory of achievement motivation and emotion. *Psychology Review*, 92, 548–573. doi: 10.1037/0033-295X.92.4.548
- Whisman, M. A., & McClelland, G. H. (2007). Designing, testing, and interpreting interactions and moderator effects in family research. *Journal of Family Psychology*, 19, 111–120. doi: 10.1037/0893-3200.19.1.111
- Winne, P. H., & Jamieson-Noel, D. (2002). Exploring students' calibration of self reports about study tactics and achievement. *Contemporary Educational Psychology*, 27, 551–572. doi: 10.1016/S0361-476X(02)00006-1
- Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, 41, 64–70.
- Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological development, and future perspectives. *American Educational Research Journal*, 45, 166–184. doi: 10.3102/0002831207312909