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Do situational academic emotions predict academic outcomes in a lecture course?

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Abstract

This study explored the relationships between situational academic emotions, self-study time, and learning outcomes in a lecture course. The participants were 107 Finnish first-year teacher students in a student-activating educational psychology lecture course. Interest and exhaustion were positively related, whereas anxiety was negatively related to the grade awarded for the course. These three situational academic emotions explained overall 29% of the course grade and they still predicted significant variance in grades even with the influences of self-reported self-study time controlled. Finally, a mediation analysis revealed that interest mediated the relationship between self-study time and learning outcomes.

Keywords: academic emotions; interest; higher education; lecture course; learning outcomes; self-study time

1. Introduction

Emotions and motivation have an increasing role in explaining university students' learning and studying (Lonka et al., 2008). Previous studies indicate that positive learning experiences are related to academic outcomes as well as to well-being (Pekrun, Goetz, Titz, & Perry, 2002). On the other hand, emotional and motivational problems in studying may pose a risk for both academic achievement and well-being (Heikkilä & Lonka, 2006). The relationships between emotions, motivation, learning outcomes and well-being have been less frequently studied (for an example see Heikkilä, Lonka, Nieminen, & Niemivirta, in press).

In our previous study (Lonka & Ketonen, in press) we used a person-oriented approach to examine what kinds of emotional profiles could be found to classify students according to the situational academic emotions they experienced during a lecture course and how these student groups differed in terms of flow experience, self-study time, and study success. In the study student groups differed significantly in all academic emotions and the groups were labeled as engaged, unstressed, and anxious students. The engaged students spent the most hours in self-study and received the best grades. The unstressed students were the least active in self-study and least exhausted but also achieved the lowest grades (Lonka & Ketonen, in press).

In the present study, we are interested in exploring more precisely which single situational academic emotions predict academic outcomes in a lecture context by using a variable-oriented approach. In addition, we want to examine what is the relation between academic emotions and self-study time when predicting learning outcomes.

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1.1. Academic emotions and their importance to learning

Pekrun et al. (2002) defined *academic emotion* as "an emotion experienced in academic settings and related to studying, learning or instruction". Such emotions are, for example, enjoyment of learning, pride of success, or test-related anxiety. Previously, academic emotions have largely been neglected in educational psychology research, with the exception of achievement-related anxiety. Pekrun (2005) suggested that students' emotions are manifold and much richer in nature than the traditional views seem to suggest. All kinds of human emotions may play a role in learning and studying, including self- and task related emotions, social emotions, and the variants of discrete emotions.

In our previous study (Lonka & Ketonen, in press) academic emotions were measured using a modified version of PANAS scale (Positive and Negative Affect Schedule, Watson, Clark, & Tellegen, 1988) which focused on positive (interest, enthusiasm, determination, energy) and negative academic emotions (exhaustion, anxiety, nervousness, irritation). The affects in the modified PANAS were chosen partially based on Pekrun's (1992; 2002; 2005) research. The variables in question were mainly similar to those previously used in contextual activity sampling by using mobile phones (Litmanen, Lonka, Inkinen, Lipponen, & Hakkarainen, in press).

Academic emotions are social in nature and emotional experiences are always situated in the immediate and broader social context (Opt't Eynde & Turner, 2006). Lonka, Olkinuora, and Mäkinen (2004) draw a distinction between three levels of context when analyzing the role of motivational and cultural factors in studying and learning: the general, domain- or course-spesific, and situational levels. The academic emotions measured in this study can be regarded as situational, since they are experienced in a certain moment. However, they are also contextual, because the lecture context and previous dispositions have an impact on what emotions are triggered.

Most investigators differentiate between so-called momentary or state emotions and long-term trait levels of affect (Diener, 1999). Instead of viewing emotion as a trait, which refers to temperamental qualities and consistent and stable long-term individual differences in affective experience, we could rather talk about various general dispositions in affective experience. A state emotion, on the other hand, usually refers to a transient reaction to specific kinds of adaptive encounters (Lazarus, 1994). For example, someone experiences anxiety at a particular time and place; the state comes and goes along with the circumstances. When emotion is viewed as a state, we want to know what it is about the situation that generates anxiety for example, distinguished from other emotions (Lazarus, 1994). In this study we refer to the above-mentioned situational-level or state emotions when applying the term academic emotions.

Teachers can influence their students' emotions, although it may be difficult to make teachers change their instructional behaviour so that student emotions are fostered (Pekrun, 2005). However, research on the impact of classroom instruction, learning environments, and social contexts on the development of academic emotions is scarce (Pekrun, 2005). Lonka and Ketonen (in press) showed that situational emotions were related to learning outcomes in a lecture course. Their result was in line with Ainley, Corrigan, and Richardson (2005) who indicated in their study that situational emotions may be central to the arousal and maintenance of students' interest, motivation, volition, and effort. It has also been shown that academic emotions are significantly related to students' learning strategies, cognitive processes, self-regulation, and academic achievement, as well as to classroom antecedents, personality, and psychological health (Pekrun et al., 2002).

Student engagement has appeared increasingly in the literature as a positive mechanism to help students improve academic performance (Schaufeli, Martínez, Pinto, Salanova, & Bakker, 2002). In our previous study (Lonka & Ketonen, in press) it appeared that engaged students reported more exhaustion than unstressed students, who did not appeared engaged. The engaged students possibly experienced exhaustion, since their course involvement was intense and they worked very hard. Students who study hard are susceptible to high exhaustion because they view their studies extremely important and place high personal demands on themselves. Sometimes exhausted university students may also skip class, do poorly on assignments and exams, and ultimately drop out of school (Law, 2007). When exhaustion is related to the presence of negative emotions it may be more harmful. However, exhaustion is not necessarily only a negative thing as long as it is related to engagement and involvement.

Learning-related enjoyment presupposes that the student has a sense of being able to master the task. On the other hand, anxiety is assumed to be triggered when expectations imply possible failure (Pekrun et al., 2002). If the challenge is high, and the feeling of competence is high, there is a possibility of experiencing flow. In contrast, if the challenge is high, but the person feels inadequate, this results in anxiety (Csikszentmihalyi, 1994). People often report positive affects, such as engagement and enthusiasm, in relation to flow, whereas more negative affects are reported when there is a mismatch between challenges and competencies (Delle Fave & Massimini, 2005). Also in our previous study (Lonka & Ketonen, in press), anxious students reported a high level of challenge but weak competence combined with high levels of negative emotions.

Generally, positive activating emotions, like enthusiasm and joy, may be assumed to affect achievement positively. In contrast, negative deactivating emotions, like boredom or apathy, may generally be detrimental because they reduce motivation and direct attention away from the task (Pekrun et al, 2002). The effect of positive deactivating as well as negative activating emotions, on the other hand, may be equivocal. Positive deactivating emotions, like satisfaction or relief, may be detrimental for

immediate performance while negative activating emotions, such as anger and anxiety, may benefit achievement (Pekrun et al., 2002). Thus, simplistic conceptions of negative emotions as bad and positive emotions as being good when predicting academic outcomes should be avoided.

In the present study, the first aim was to investigate which single situational academic emotions are related to academic outcomes in a lecture course. The academic emotions were measured contextually by using a questionnaire during a lecture situation. It was revealed already by the person-oriented approach that different emotional student profiles had different learning outcomes (Lonka & Ketonen, in press). Furthermore, in the present study self-reported self-study time was included as an additional variable to predict learning outcomes. We wanted to explore whether self-study time would function as a predictor of learning outcomes independent of the contributions of the academic emotions, and on the other hand, whether academic emotions would predict learning outcomes in regressions even if self-reported self-study time was included and controlled in the model.

1.2. The role of interest in studying and learning

In our previous study, interest was central in study engagement (Lonka & Ketonen, in press). Interest may be defined as a psychological state that is characterized by an affective component of positive emotion and a cognitive component of concentration (Hidi & Renninger, 2006). It is a mental state where intellectual activity has a target and where positive emotions are involved (Tsai, Kunter, Ludtke, Trautwein, & Ryan, 2008). Thus, interest is always content-specific and not a predisposition that applies generally across all activities (Krapp, 2000). Interest develops in the interaction between a person and the surrounding context. The potential for interest is in the person but the context and the environment define the direction of interest and contribute to its development (Hidi & Renninger, 2006). Such instruction that activates prior knowledge, supports autonomy and a sense of control, and where the goals are transparent, has been reported to promote interest (Tsai et al., 2008).

According to the proposal made by Krapp, Hidi, and Renninger (1992), most researchers differentiate between situational and individual or personal interest. Hidi and Renninger (2006) presented the *model of how interest develops*. The first phase of the four-phase model presented by Hidi and Renninger (2006) is a *triggered situational interest*. For instance, an interesting text or lecture may trigger this kind of interest. If situational interest is sustained, it elaborates into the second phase, that is, *maintained situational interest*. The student may read more about the topic or return to listen to the interesting speaker, for example. The third phase is characterized by *an emerging individual interest*. It takes place, if the student begins to pose curiosity questions, seek repeated engagement and has not only positive feelings but also increased stored knowledge and value for particular content. If maintained by active deep learning, emerging individual interest may lead into the fourth phase, namely, *a well-developed individual interest*. This phase allows the individual to sustain long-term learning activities.

Earlier phases of interest development appear to be fuelled by affect, but each phase also includes some form of prior knowledge or cognitive processing although the latter components are more pronounced in the later phases. It is important to point out that triggered situational interest may take place without effort, but individual interest calls for prior knowledge (Hidi & Renninger, 2006). Thus, interest includes always not only affective but also cognitive components. Prior knowledge, for instance, has been shown to be associated with more interest (Alexander, Jetton, & Kulikowich, 1995). However, knowledge is not a sole component of interest, nor is affect. Interest development involves the interaction of knowledge and affects (Hidi & Renninger, 2006).

Interest has repeatedly been recognized as an important condition for learning. The empirical findings show that learning based on interest tends to have many positive effects on the process and results of learning, especially with respect to qualitative criteria (Krapp, 2002). For example, situational interest has been shown to influence positively cognitive performances such as focused attention, higher cognitive functioning, and learning (Hidi & Renninger, 2006). Harackiewicz, Barron, Tauer, and Elliot (2002) reported that interest combines with external factors to predict academic outcomes among college students. One possible mechanism is that situational interest makes students work harder and become engaged, which again leads to better learning outcomes. In addition, the positive emotions associated with interest have been found to contribute to cognitive performance (Ainley, Hillman, & Hidi, 2002; Krapp, 2002).

Previous research indicates that emotions may be critical for the arousal and maintenance of interest (Pekrun, 2005). For example situational emotions triggered by a text can transform into an interest to continue reading. In Pekrun et al.'s (2002) study, positive academic emotions correlated positively with students' interest and self-reported academic effort. In contrast, negative deactivating emotions correlated negatively with interest and self-reported effort. Also Hidi and Renninger (2006) emphasize the importance of positive emotions in the development of interest. In our previous study (Lonka & Ketonen, in press), engaged students reported high levels of interest but at the same time some exhaustion. Students who feel most dedicated to their study usually show the least cynicism, but do not necessarily feel low in exhaustion (Schaufeli et al., 2002). Thus, it seems that interest is a positive emotion that prevents cynicism but can at the same time lead into 'positive' exhaustion.

In the present study we treat interest as an affect. Interest can be perceived as an emotional experience, when it is seen as a pleasant and activating emotion in contrast to unpleasant and deactivating affect like boredom (Barrett, Mesquita, Ochsner, & Gross, 2007; Watson et al., 1988; Yik, Russell, & Feldman Barret, 1999). We are aware, however, of its close linkage to attention and cognition and that it is not a general feature, but has always a target (Renninger & Hidi, 2011). In the present study we investigated how reported interest is related to academic outcomes and further, the time invested in self-study. This lecture was previously reported to be highly interesting and engaging from the participants' perspective (Lonka & Ketonen, in press). Thus, the second goal of the study was to explore whether interest mediated the relationship between self-study time and learning outcomes. In sum, the present study was designed to explore the relationships between academic emotions, self-study time, and academic outcomes in a lecture context.

2. Method

2.1. Participants

The participants were 107 Finnish first-year elementary- and kindergarten teacher students who attended an introductory course in educational psychology at the University of Helsinki. Overall, 77% of the students who attended the course filled in the questionnaire used in this study. The ages ranged from 19 to 51 years (mean 23.6, standard deviation 5.37). Women (85%) were overrepresented in this study compared to men (15%), which reflects the gender distribution in teacher education at the University of Helsinki.

2.2. Procedure

The data were collected in December, 2009 from students attending a student-activating lecture course in educational psychology (the context is described in more detail in Lonka & Ketonen, in press). The participants filled in a questionnaire during the last lecture of the course, five days before the course exam.

The purpose of the study was explained to all participants. It was emphasised that the involvement was voluntary and that the participants could decide not to complete the questionnaire at any time. All participants signed an informed consent form, including a consent to gather the course grades. Of the 107 participants, 92 both filled in the questionnaire and attended the course exam. In statistical analyses, the largest possible number of participants was included in each analysis.

2.3. Materials

The self-report questionnaire consisted of Likert-type questions to assess academic emotions, motivational factors, problems in studying, and procrastination. In this study, we focused on academic emotions which were each measured on a situational level in a certain context. Academic emotions were assessed using a modified PANAS scale (Watson et al., 1988; see also Litmanen et al., in press; Tolvanen et al., 2011), consisting of four positive affects (interest, enthusiasm, determination, energy) and four negative affects (exhaustion, anxiety, nervousness, irritation). All items were answered using a Likert-scale ranging from (1) not at all to (7) very much. In addition, the participants were asked to evaluate how many hours they had spent on self-study by the time they filled in the questionnaire.

Learning outcomes were measured by using the grades obtained from the course from which the data were collected. The course exam was arranged five days after the last lecture and called for understanding and application of knowledge, and learning details by heart was not rewarded. The final grade was given on the European Credit Transfer and Accumulation System (ECTS) scale of 1(no understanding) to 5 (deep understanding).

3. Results

3.1. Descriptive analysis

Mean scores, standard deviations, and the range of scores are presented in Table 1 for each variable used in this study. The scores indicate that the participants felt more positive than negative emotions and found the course very interesting. The participants were also quite enthusiastic and determined five days before the course exam. The reported hours spent on self-study

indicate that on average, students had reported having spent relatively little time on self-study five days before the exam, but there was still a broad range of variance among students. Grades for the course exam were comparably high.

Table 1

Descriptive Statistics for Academic Emotions, Self-study Time, and Learning Outcomes

Variable	*n*	*M*	*SD*	*Scale*	*Min. /Max.*
Interest	107	5.25	1.20	1-7	1/7
Enthusiasm	106	4.54	1.27	1-7	1/7
Determination	105	4.16	1.20	1-7	1/7
Energy	106	3.52	1.24	1-7	1/7
Irritation	105	2.73	1.44	1-7	1/7
Nervousness	106	3.65	1.61	1-7	1/7
Anxiety	106	3.70	1.82	1-7	1/7
Exhaustion	107	3.76	1.48	1-7	1/7
Self-study time (hours)	103	12.19	11.08		0/60
Learning outcomes	92	3.59	0.76	1-5	2/5

Table 2 shows the Pearson product moment correlations between the variables measured in this study. As expected, interest, enthusiasm, determination, and energy all correlated positively with each other, whilst irritation, nervousness, anxiety, and exhaustion correlated mutually as well. There were mainly negative correlations between positive and negative affects. Self-study time correlated positively with all the positive emotions. Learning outcomes were positively related with interest, enthusiasm, and self-study time. The lack of other significant correlation suggests that positive emotions have a more significant role in self-study and learning outcomes than negative emotions have. However, correlations reveal only the linear relations between the variables.

Table 2

Pearson Product-moment Correlations between Academic Emotions, Self-study Time, and Learning Outcomes

	1	2	3	4	5	6	7	8	9
1 Interest									
2 Enthusiasm	.720**								
3 Determination	.211*	.445**							
4 Energy	.452**	.599**	.562**						
5 Irritation	-.508**	-.503**	-.133	-.415**					
6 Nervousness	-.044	-.141	-.103	-.181	.442**				
7 Anxiety	-.122	-.284**	-.227*	-.403**	.479**	.594**			
8 Exhaustion	-.151	-.329**	-.186	-.376**	.551**	.502**	.698**		
9 Self-study time	.347**	.290**	.319**	.255**	.050	.134	.074	.050	
10 Learning outcomes	.405**	.257**	.056	.178	-.114	-.137	-.073	.138	.330**

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

3.2. Predicting academic outcomes

A stepwise multiple regression analysis was performed to predict learning outcomes. All eight academic emotions listed in Table 1 were entered into the analysis as possible independent predictor variables. Table 3 shows the results. Of the eight academic emotions interest, exhaustion, and anxiety accounted for significant shares of the course grade variance, with interest and exhaustion being the most significant single predictors of learning outcomes. The higher the student assessed his or her interest and exhaustion and the lower he or she assessed the level of anxiety, the better the student tended to do in the course exam. These three variables explained 29% of the variance (measured by R^2) and were all significantly related to course grade at $p < .004$ or beyond.

Table 3

Stepwise Multiple Regression Analysis Predicting Learning Outcomes from Academic Emotions

	Learning outcomes
Variable	β
Interest	.47***
Enthusiasm	-.07
Determination	-.08
Energy	.01
Irritation	.05
Nervousness	-.20
Anxiety	-.39**
Exhaustion	.48***
R^2	.29
F	11.81***

Note. $N = 89$.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In addition to academic emotions, one additional variable included in the second regression analysis as a possible predictor was an estimate of self-study time. To determine how much predictive power self-reported self-study time and academic emotions have on learning outcomes, the second analysis consisted of a hierarchical multiple regression model to predict the course grade. Predictors were included in two blocks in the following order. First, self-study time was entered as the first block to include variance attributable to time invested in self-study before the emotional influences were included. The second block consisted of three academic emotions (interest, exhaustion, anxiety) which were proven to be significantly related to learning outcomes in the first analysis. The results of the second regression analysis appear in Table 4.

The addition of both blocks of predictors significantly increased the proportion of variance explained in the learning outcomes. In the first step, self-reported self-study time significantly predicted course grades. However, with the addition of interest, exhaustion, and anxiety in the second step, self-study time did not remain a significant predictor. Thus, in the final equation after the second step, learning outcomes were significantly predicted by academic emotions only, similarly to the first regression analysis. Taken together, the second regression model accounted for 35% of the explained variance in students' learning outcomes.

Table 4

Hierarchical Multiple Regression Analysis Predicting Learning Outcomes from Interest, Anxiety, and Exhaustion after Controlling for Self-study Time

	Learning outcomes		
		Model 2	
Variable	Model 1 β	β	95% CI
Self-study time	.37***	.19	[-0.00, 0.21]
Interest		.42***	[0.01, 0.04]
Anxiety		-.42**	[-0.28, -0.07]
Exhaustion		.48***	[0.11, 0.37]
R^2	.14	.35	
F	13.54***	11.10***	
ΔR^2		.21	
ΔF		9.04	

Note. $N = 89$. CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

3.3. The mediating role of interest

To test if interest acts as a mechanism through which self-study time predicts academic outcomes, a mediational analysis was conducted following the recommendations of Baron and Kenny (1986). All variables are required to correlate significantly with each other in order to the mediation to be examined. Self-study time correlated significantly with interest, $r = .35$, $p < .001$; and learning outcomes, $r = .33$, $p < .001$. Likewise, interest was significantly associated with learning outcomes, $r = .41$, $p < .001$. Therefore, the preconditions of mediation (Baron & Kenny, 1986) were met. Figure 1 illustrates that the direct path from self-study time to learning outcomes remained significant after the inclusion of interest in the analysis; however, the basic relationship was significantly reduced, Sobel's $z = 2.54$, $p = .01$, CI 95% [0.02, 0.13].

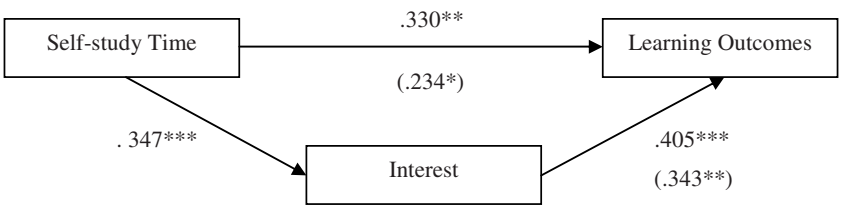

Figure 1. Interest Mediates the Relationship between Self-study Time and Learning Outcomes
* $p < .05$. ** $p < .01$. *** $p < .001$.

Because the sampling distribution of the indirect effect is not always symmetrical or normal, especially in small samples (Bollen & Stine, 1990); we also used bootstrapping which produces a test that is not based on large-sample theory, meaning it can be applied to small samples with more confidence. The bootstrapped estimate of the indirect effect was similar to the point estimate computed from the conventional regression analysis of the raw data, and the true indirect effect was estimated to lie between 0.0160 and 0.1367 with 95% confidence. Because zero is not in the 95% confidence interval, we can conclude that the indirect effect is indeed significantly different from zero at $p < .05$ (two-tailed).

Thus, interest partially mediated the relationship between self-reported self-study time and learning outcomes. The mediating path (indirect path) from self-study time to learning outcomes was also significant; however, the direct effect of self-study time on learning outcomes ($r = .23$) was stronger than the indirect path through interest ($r = .10$). For the ease of interpretation, all values presented in the figure 1 are standardized coefficients.

4. Discussion

This study showed how situational academic emotions played an important role in successful studying. In a lecture context the academic emotions measured five days before the course exam significantly predicted academic outcomes.The results of the regression analyses suggest that a greater interest contributes significantly to students' learning outcomes in a lecture course. The finding is consistent with previous research (Hidi & Renninger, 2006; Krapp, 2002).

Interestingly, exhaustion was not harmful in this context. Exhaustion related positively to course grade, suggesting, perhaps, a commitment to the studies. This is in line with previous studies indicating that committed students may sometimes be exhausted (Schaufeli et al., 2002) and stressed (Litmanen, Hirsto, & Lonka, 2010), since they invest a lot of hard work in studying. Thus, instead of being a negative consequence, exhaustion can be seen here as a positive sign of vigour, dedication, and absorption, all of which are characteristic of engagement (Schaufeli et al., 2002).

Anxiety, on the other hand, appeared to be harmful in terms of academic outcomes in this context. Previous research showed that test anxiety can reduce working memory resources, leading to an impairment of performance at complex or difficult tasks that draw on these resources. Consequently, test anxiety tends to correlate negatively with academic achievement at school and university (Pekrun et al., 2002). However, the effects of negative activating emotions seem to be ambivalent. Because of their activating nature, negative activating emotions can induce a strong motivation to cope with the negative events that caused them, thus strengthening specific kinds of extrinsic motivation. For example, test-related anxiety may induce the motivation to avoid failure by investing effort, thus strengthening academic motivation (Pekrun et al., 2002). However in this context anxiety seemed to lead to behavioral freezing instead of activation.

The lack of other significant relations with course grade suggests that general enthusiasm, determination, or energy might not be as decisive when predicting learning outcomes compared to interest which differs from the other positive emotions due to the fact that it always has a target and intellectual activity is involved (Tsai et al., 2008). On the other hand interest is a mental state where positive emotions are highly involved (Tsai et al., 2008) and because of the strong correlations between all the positive emotions, there may not have been predictive power left to the other affects after interest was included in the model.

However, only 29% of the total variance in course grades was accounted for in the first regression model suggesting that although academic emotions are important contributors to learning outcomes, other factors not assessed here like previous knowledge and performance, achievement goals and different test-related situational factors must also contribute in a major way to academic outcomes. In the second regression analysis we added self-reported self-study time to the model to see if this factor could explain the achieved grades even more than the academic emotions. Surprisingly, interest, exhaustion, and anxiety remained significant even with variance owing to self-reported self-study time included and controlled in the second regression model. In fact, reported academic emotions were more powerful predictors of learning outcomes than invested self-study time five days before the course exam. After adding interest, exhaustion, and anxiety in the model, self-reported self-study time did not remain a significant predictor. This finding further emphasises that experienced emotions are important when predicting successful studying. Furthermore, these results suggest that self-study time may not be as important a predictor of academic outcomes as are academic emotions, at least in certain academic contexts.

It was not clear why such a general measure of studying as self-reported time spent on self-study did not emerge as a predictor of learning outcomes when emotional influences were included. The finding that interest in this study was a better predictor of learning outcomes than was self-reported self-study time may reflect in part the nature of demands of the course exam, calling for understanding and application of knowledge, not remembering details by heart. In addition, the mediation analysis revealed that the relationship between self-study time and learning outcomes was partially mediated by the interest experienced. Conceptually, this means that self-study time is associated with academic outcomes also through a mechanism of increased interest. This finding refers to the conception that more reading or studying also increases interest in the topic and that particularly individual interest calls for prior knowledge (Hidi & Renninger, 2006).

Although we did not have longitudinal data, which could more fully elucidate causal pathways, the indirect effect identified here with concurrent data suggests that self-study predicts increased interest, and this, in turn, predicts better learning outcomes. Because this study used concurrent data, it is not possible to disentangle the direction of causality among these variables. We assumed, however, based on theoretical background and previous research that studying and increase in knowledge could prompt an increase in interest (Alexander et al., 1995; Hidi & Renninger, 2006). It is likely, however, that there is a reciprocal relationship between these factors, where interest also plays a causal role on self-studying. Further studies should replicate this pathway with larger sample sizes and longitudinal data.

Our findings point also to the need for studies of how the characteristics of the academic context may mediate the relationship between academic emotions and learning outcomes. Our ongoing studies in the field of engineering and other domains shall show whether we can generalize these results. Besides the context and the domain also the phase of study can impact on results. It would be interesting to examine if the results are similar among more advanced students. Also a longitudinal study that examines how students' general study orientations are related to experienced situational academic emotions, and the other way

round – do these situational academic emotions have an influence on the development of general orientations – would appear to be in order. Research is needed to test potentially reciprocal longitudinal relationships between general dispositions and situational factors in studying to better understand the direction of effect between these factors. In future, we are also interested in how academic emotions are related to students' general motivation, well-being, achievement, and quality of learning instead of single grades.

Furthermore, new contextual ways of measuring academic emotions have been developed. For instance, our Finnish research group measured academic emotions, interest, sense of competence, and challenge using the Contextually Activated Sampling System (CASS) method (Litmanen et al., in press; Muukkonen et al., 2007; Muukkonen, Hakkarainen, Inkinen, Lonka, & Salmela-Aro, 2008; Tolvanen et al., 2011). This method enables gathering real time data of academic emotions also in contexts other than a formal lecture situation.

While it seems clear that students' emotions develop in social contexts, we do not yet know how this process can be fostered so that enjoyment of learning is enhanced, and so that negative emotions hindering learning are prevented or put to productive use. Future research on academic emotions should include more intervention studies and provide information on how instruction and social interaction with students can be modified to foster students' emotional development.

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