



Extending the change–change model of achievement emotions: The inclusion of negative learning emotions



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ARTICLE INFO

Article history:

Received 15 November 2014

Received in revised form 22 November 2015

Accepted 22 December 2015

Keywords:

Academic learning-related emotions

Perceived academic control

Change–change model

First year of university

Mathematics and statistics

ABSTRACT

Drawing upon the Control Value Theory of Achievement Emotions (CVTAE), this study tests the assumption that antecedents of learning-related emotions (LREs) change over the duration of a mathematics and statistics course. Our study focused on academic control as an antecedent of LREs. We investigated enjoyment (the positive emotion) and three negative LREs: anxiety, boredom and hopelessness. Using a repeated measures design for first year university students ($N = 908$), we found that academic control and the levels of LREs remain, on average, stable over the duration of the course. Second, changes in academic control were positively related to changes in the positive emotion enjoyment, and negatively related to changes in the three negative emotions. These findings offer evidence to confirm the CVTAE change–change assumption that changes in control appraisals go together with changes in positive, as well as negative, LREs.

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1. Introduction

In today's educational and psychological research, it has become increasingly important to examine students' emotional experiences (Linnenbrink-Garcia & Pekrun, 2011; Schutz & Lanehart, 2002). Research on emotions in education shows that emotions are an inherent factor in any learning process (Schutz & Lanehart, 2002) and that they can be particularly “ubiquitous” in academic settings (Pekrun & Stephens, 2010). Emotions experienced in academic settings have an important contribution to students' motivation and can influence learning outcomes, such as academic performance (Pekrun, 2006). Academic emotions are a specific type of emotional experience, defined as “emotions that are directly linked to achievement activities and outcomes” (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011, p.37). According to Goetz, Frenzel, Stoeger, and Hall (2010) both positive and negative emotions should be given equal attention in academic contexts. Furthermore, Goetz, Cronjaeger, et al. (2010); Goetz, Frenzel, et al. (2010) recommend that future research should ascertain the inclusion of both negative and positive emotions. While positive emotions have a clear relevance as end states as well as processes in achieving positive outcomes in education (Fredrickson, 2001), negative emotions are particularly known for their adverse effects on students' academic achievement (Goetz, Pekrun, Hall, & Haag, 2006). Further investigation of these factors might contribute to the design of

interventions aimed at decreasing the levels of negative emotions in educational settings (Pekrun, Goetz, Titz, & Perry, 2002).

The most obvious setting in which to conduct such an investigation is the first year at university study. Recent research has demonstrated that negative academic emotions are detrimental factors especially in this period (Tempelaar, Niculescu, Rienties, Gijssels, & Giesbers, 2012). First years' unpleasant emotions seem particularly intense and can influence how students perform within a course (Pekrun et al., 2011) with further consequences on the overall achievement at university (Hall, Perry, Ruthig, Hladkyj, & Chipperfield, 2006). Given the importance of negative emotions, it appears relevant to develop further understanding on why students experience unpleasant emotions during this time. From a theoretical stand, one of the most influential contemporary frameworks addressing this question is the Control-Value Theory of Achievement Emotions (CVTAE; Pekrun, 2006). According to CVTAE, distinct negative emotions emerge from beliefs about a low capacity to influence outcomes (Frenzel, Pekrun, & Goetz, 2007; Pekrun, 2000), generally referred to as control appraisals (Pekrun et al., 2002). For instance, when students are confronted with novel situations they usually perceive low control, yet still hold high expectations for success (Perry, Hladkyj, Pekrun, Clifton, & Chipperfield, 2005). These perceived conditions typically create negative emotional reactions towards learning in academic situations (Stupnisky, Perry, Hall, & Guay, 2012). Despite serious theoretical advances on the role of emotions in academic settings (Elliot & Pekrun, 2007), empirical evidence rarely outlines negative academic emotions in relation to its antecedent factors (Goetz, Cronjaeger, Frenzel, Lüdtke, & Hall, 2010). Furthermore, research is needed in the first at university to help us

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understand how negative emotions emerge (Linnenbrink, 2006; Schutz & Pekrun, 2007) and further develop over time (Buff, 2014). In this study we focus on control appraisals as antecedent factors for both positive and negative academic emotions in the first year at university. According to the CVTAE, we first investigate how these emotions emerge from control appraisals. Then, we investigate if changes in control appraisals relate to changes in academic emotions at two instances over the duration of a course.

In the following section we will: 1) describe the different types of settings in which academic emotions are encountered within a course; 2) describe control appraisals as antecedents of academic emotions, and 3) provide empirical evidence linking control appraisals and academic emotions. The aim of this study and the expected hypotheses are stated at the end of this section.

1.1. Conceptual framework

According to Pekrun et al. (2002), there are three important academic settings to experience emotions in a course: 1) being in class, 2) taking tests and exams, and 3) studying outside of class. Each of these settings raises a different type of emotion: class-related, test-related and learning-related emotions. While other emotional settings have been extensively studied, such as the exam situation, few studies have actually paid attention to situations outside the class (Linnenbrink, 2006; Putwain, Sander, & Larkin, 2013; Schutz & Pekrun, 2007; Trautwein, Schnyder, Niggli, Neumann, & Lüdtke, 2009). These studies demonstrate a clear need to investigate learning-related emotions (LREs), since the first year at university puts an accent on heightened self-reliance and autonomy (Perry, Hladkyj, Pekrun, & Pelletier, 2001), which are required in situations involving individual study or preparing the homework.

Of particular relevance is the role of LREs in abstract or difficult subjects, such as mathematics and statistics. Indeed, two extensive lines of research prove that these two subjects are the most induced anxiety courses at all educational levels, from gymnasium to university (e.g., Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013; Hofman, 2010, for math anxiety; e.g., Baloglu, Deniz, & Kesici, 2011; Chew & Dillon, 2014, for statistics anxiety). Recent research on students' emotional experiences during mathematics homework (Dettmers et al., 2011; Goetz et al., 2012) shows that the homework assignments are considered “emotionally charged activities” (Dettmers et al., 2011, p. 25), where students seem to experience the most unpleasant emotions when compared with other academic situations (Leone & Richards, 1989). Furthermore, Dettmers et al. (2011) found that elevated levels of negative emotions influence students' amount of effort and disengagement from study to negatively predict achievement in mathematics. In another secondary education study by Goetz et al. (2012), it was showed that emotional experiences during homework are not depending on students' age and seem not to change after grade eight. Moreover, Ahmed, van der Werf, Kuyper, and Minnaert (2013) analyzed the developmental trends of enjoyment, pride, boredom and anxiety in mathematics over a school year in Grade 7 students to show that changes in positive emotions were systematically associated with changes in self-regulated learning and achievement. Tempelaar et al. (2012) build further to confirm similar mechanisms in higher education. Their study showed control appraisals as a mediator between negative effort views – the belief students hold towards exerting effort as something which signals lacks of intelligence, therefore negative (Dweck, 1999) – and boredom towards learning in mathematics and statistics. More specifically, there was evidence for a strong positive direct relationship between negative effort and boredom. In addition, there was an indirect relationship through control, indicating that for given levels of negative effort, academic control contributes positively to boredom. Finally, these individual differences in achievement emotions had an impact on student learning choices in mathematics and statistics. In general, studying or preparing homework for mathematics and statistics is recognized as a

problem even for students with high cognitive abilities. Research shows that learning is impeded by negative attitudes and beliefs students hold towards such courses (Gal & Ginsburg, 1994; Garfield & Ben-Zvi, 2007). In summary, to understand the impact of negative LREs in domains which are perceived as difficult, such as mathematics and statistics, it is necessary to know: 1) if students experience changes in the levels of their emotions over time and, 2) the factors from which these changes emerge. By knowing if negative academic emotions change over a course, as well as the factors that determine their change, can inform the design of educational interventions to create “emotionally sound” (Astleitner, 2000) learning environments. Implicitly, the re-design of educational environments which account for students' academic emotions as well as the factors that contribute to them, could potentially improve academic achievement.

For the purpose of our study, we build further on the work of Tempelaar et al. (2012) which acknowledges the importance of achievement motivation and emotion on learning when students enter university. In addition, we want to reveal how LREs emerge and develop over a mathematics and statistics course. We focus on four emotions experienced in learning situations: the positive emotion enjoyment and three negative emotions: anxiety, boredom and hopelessness. Class-related emotions and test emotions were deemed to be beyond the scope of our study, as learning enjoyment, anxiety and boredom are shown to be particularly salient in academic settings (Goetz et al., 2006). Furthermore, the choice of these learning-related emotions is justified by previous research showing them as the prime emotions related to academic achievement (Pekrun, 2000, 2006; Pekrun et al., 2011, 2002). Control appraisals are considered as antecedents of the four LREs.

1.2. Antecedents of learning-related emotions

Within mathematics and statistics courses, distinct negative emotions emerge from students' beliefs about a low capacity to influence outcomes (Frenzel et al., 2007; Pekrun, 2000) and the value attributed to these outcomes, generally referred to as control appraisals and value appraisals, respectively (Pekrun et al., 2002). It is useful to mention that “control appraisals” are operationalized by Pekrun et al. (2002) as either perceived control, self-concept, expectancy, or self-efficacy. For instance, anxiety during learning for mathematics and statistics can occur when a student does not feel very competent towards the course materials while obtaining a good grade is considered important. The Control-Value Theory of Achievement Emotions (CVTAE) postulates that appraisals of control and value act as direct or proximal antecedents of learning-related emotions (LREs): higher levels of control and value predict higher levels of positive emotions, and lower levels of negative emotions respectively (Pekrun, 2006). However, Pekrun (2006, p. 320) asserts that “for low expectancies of success ..., hopelessness is posited to be the emotion experienced, provided that success and failure are subjectively important”. In the same way, Pekrun (2006, p. 321) asserts “For example, if failure can happen at an important exam, but control seems not be possible, anxiety will be experienced”, indicating the existence of nonlinear effects.

In a longitudinal context, this postulate implies that increasing levels of control and value appraisals raises the levels of positive emotions, (such as joy), and lowers the levels of negative emotions, (like anxiety). Likewise, a decrease in the levels of the antecedents has an opposite effect. In other words, this assumption – referred to as the change–change parameterization of CVTAE (Buff, 2014) – has two practical implications: increasing the levels of LREs' antecedents is expected to raise the levels of positive and decrease the levels of negative emotions. This assumption was empirically investigated and confirmed by Buff (2014) for the positive LRE of enjoyment. Indeed, Buff (2014) found that positive changes in perceived control and value lead to positive changes in enjoyment of learning in mathematics. Beyond this one study, which looks solely at a single, positive LRE enjoyment (as in

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