An Evaluation of Boredom in Academic Contexts

by

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Abstract

The impact of academic boredom on learning and achievement has received increasing attention in the literature because academic boredom is associated with lower academic outcomes. In this dissertation, academic boredom was examined in three separate articles. The first article presents a meta-analysis that explores the relationship between students' academic boredom and their motivation, study strategies and behaviours, and performance. The overall results showed a significant (negative) relationship between the key variables, moderated by age. Boredom experienced in class had greater negative impact on students' academic functioning than boredom experienced during studying. In addition, a significant differential impact of boredom on academic motivation, study strategies and behaviours, and achievement was found.

The second article examines changes in academic boredom over time in a sample of 144 university students. The article a) examines the patterns of change in two types of academic boredom (learning-related and class-related) and in four types of student engagement (vigor, absorption, dedication, and effort regulation); b) examines how the trajectories of boredom and student engagement relate to one another; and c) evaluates the influence of perceived autonomy support on the pattern of change in boredom. Results of latent growth curve analysis showed that learning-related boredom, vigor, and absorption remained relatively stable over time, whereas both class-related boredom and effort regulation showed a linear change, a pattern of increase and a trend of decrease, respectively. Interestingly, students' dedication decreased at the beginning and increased when approaching the end of the course. Results also revealed the negative impact of perceived autonomy support on class-related boredom experience, and the fact that changes in boredom in class were linked with changes in both effort regulation and dedication.

The third article presents a boredom scale validation. The article investigates the validity of the English Precursors to Boredom Scales (E-PBS) in a sample of Canadian college students and examines the criterion-related evidence between the E-PBS and students' self-efficacy for self-regulated learning (SESRL) and achievement. Findings showed that the factor structure and item loadings of the E-PBS were comparable with those found in samples from Germany, where the scale was initially validated. Results also indicated significant negative associations between SESRL and four antecedents to boredom (i.e., boredom due to being over-challenged, lack of meaning, opportunity costs, and general boredom tendency). However, only one significant negative correlation involving students' achievement emerged; that is, the correlation between achievement and being under-challenged was significant and negative.

Taken together, the three articles in the dissertation show the importance of understanding academic boredom in learning contexts. The key findings of this three-article dissertation and implications for future research are discussed in the General Discussion and Conclusion.

Preface

The research projects presented in this thesis received research ethics approval from the University of Alberta Research Ethics Board: “Pre-service teachers' perspectives on motivation, emotions, and life in general”, No. Pro00031624, August 13, 2012, for the study reported in Chapter 3; and “Student teachers’ motivation and emotions”, No. Pro00014773, August 24, 2010; and “Relationship of physical activity to academic motivation and emotions”, No. Pro00010998, December 22, 2009, for the studies reported in Chapter 4.

Chapter 2 of this thesis, “Evaluating the effects between academic boredom and learning: A meta-analysis,” has been presented at the annual conference of The British Psychological Society, Harrogate, United Kingdom in 2013 and is under review at *Educational Psychology Review*.

Chapter 3 of this thesis has been published as V. M. C. Tze, R. M. Klassen, and L. M. Daniels (2014), “Patterns of boredom and its relationship with perceived autonomy support and engagement,” *Contemporary Educational Psychology*, vol. 39, 175-187. I was responsible for the design of study, data collection and analysis, as well as the manuscript composition. R. M. Klassen and L. M. Daniels were the supervisory authors and were involved with manuscript composition and editing.

Chapter 4 of this thesis has been published as V. M. C. Tze, L. M. Daniels, and R. M. Klassen (2014), “Examining the factor structure and validity of the English Precursors to Boredom Scales,” *Learning and Individual Differences*, vol. 32, 254-260. I was responsible for formatting research hypothesis, analysis of the data and compositing the manuscript. L. M. Daniels and R. M. Klassen were the supervisory authors and contributed to the data collection, manuscript composition and editing.

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CHAPTER ONE: INTRODUCTION

Students experience a wide range of emotions in academic contexts. D'Mello, Lehman, and Person (2010) found not only that university students experienced positive emotions (e.g., curiosity, happiness, and surprise) when doing academic work, but that they also felt a range of negative emotions, such as boredom, frustration, and anxiety. In Goetz, Preckel, Pekrun, and Hall's (2007) study, elementary school students reported varying intensities of emotions during a mathematics test, including enjoyment, boredom, anxiety, and anger. Despite this wide range of emotional experiences, each of which could be the subject of further study, most scholarly attention has been given to investigations of anxiety, with less attention paid to the full range of academic-related emotions. Recently, other academic-related emotions—especially boredom—have garnered more attention from researchers (e.g., Acee et al., 2010; Daniels et al., 2008; Frenzel, Pekrun, & Goetz, 2007). Building a deeper understanding of academic boredom is important because boredom has been shown to be negatively related to students' learning (e.g., Tze, Daniels, Klassen, & Li, 2013). The purpose of this three-article dissertation is to build a better understanding of a relatively under-researched area—boredom—in academic settings. Each individual article, presented as an individual chapter, will discuss related empirical studies and theoretical frameworks in greater detail. To set the stage, a review of emotion theories is presented in the following section, followed by a conceptualization of academic emotions and a definition of boredom, and subsequently a discussion about potential negative and positive effects of being bored. To conclude this chapter, a summary of the purposes of each individual article will be presented.

Theories of Emotions

The scientific study of emotions has existed for over four decades (e.g., Ekman, Sorenson, & Friesen, 1969; Ekman, 1992; Levenson, 2011; Stein & Oatley, 1992). A general consensus has been reached with regard to what are essential qualities of basic emotions: they are discrete, have unique neural signals/components and physiological responses, and elicit an unambiguous feeling to stimuli for adaptive functioning (Tracy & Randles, 2011). However, as Tracy and Randles further noted, there is still disagreement with regard to the total number of basic emotions as well as the "terminology" used among researchers and theorists in the area. Despite the differences in points of view about the basic make-up of emotions, it is generally agreed that there are five basic emotions[1], namely happiness, sadness, fear, anger, and disgust.

Basic emotions can also be considered as "genetically-based emotions" (p.147, Pekrun, 2000), and are important in individuals' early years of development. For instance, a toddler shows fear when s/he sees a barking dog, triggering a cry for help. By contrast, complex or "cognitive-mediated emotions" may become more important across life stages and in various situations (Pekrun, 2000), and as Shuman and Scherer (2014) discussed, there are three other emotion theory camps, namely appraisal (e.g., Ellsworth & Smith, 1988; Moors, Ellsworth, Scherer, & Frijda, 2013; Roseman, 1996; Scherer, 2005), psychological constructionist (e.g., Barrett, 2009; Lindquist, 2013; Russell, 2009), and nonlinear dynamic systems theories (e.g., Fogel et al., 1992), providing different perspectives on understanding of emotions.

The key component in appraisal theory is cognitive appraisal, and different emotions are induced by how individuals cognitively evaluate a circumstance (e.g., relevance and congruence to one's goal and locus of control) (Moors et al., 2013). Shuman and Scherer (2014) further discussed that appraisal not only serves as an antecedent to a given emotional experience but it also interacts with other emotion components, such as behavioural and physiological expressions, in a dynamic fashion. By contrast, in psychological constructionist theory, the emphasis is that "individual token events [are psychologically constructed to] be classified as emotion, fear, anger and the like" (p. 1267) even though emotional experience may include some typical emotion components, such as appraisal, facial and behavioural expressions, and core affect (Russell, 2009). In other words, emotion is a mental "categorization" or "interpretation" (p. 362, Lindquist, 2013) of a number of interrelated, on-going, psychological processes, such as attribution and physiological responses (e.g., Russell, 2009). As Lindquist notes, the key difference between appraisal theory and psychological constructionist theory lies on an assumption of linear causal influence of cognitive appraisal in emotional experience in the former, but not in the latter. Contrary to both appraisal and psychological constructionist theories, the nonlinear dynamic system theory emphasizes that no single component plays a central role in determining an emotional state, but a given emotion is experienced when components are "organized into coherent patterns" (p. 129) and once stabilized, it is difficult to change (Fogel et al., 1992).

There is no doubt that these theoretical frameworks together advance our understanding of emotions, but it is also clear that context plays a key role in the experience of emotions. One context pertinent to children and adolescents is the educational setting. Specifically, given that standards and rules in educational settings are often based on socially constructed norms (Pekrun, 2000), emotions elicited through cognitive appraisal of situations and events have received more attention in the literature, and the most-researched emotion in educational setting is anxiety (e.g., Davis, DiStefano, & Schutz, 2008; Ramirez, Gunderson, Levine, & Beilock, 2013; Satake & Amato, 1995; Sharma, 1970). However, there is still a gap in our understanding of the full range of emotions in educational settings, and in particular for *boredom* that may be less disruptive to classroom instruction but may still impede students' learning (e.g., Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010).

Conceptualization of Academic Emotions

To understand emotions experienced in education settings, in particular related to achievement-related activities, Pekrun (2006) developed an integrative theoretical framework to delineate and differentiate academic emotions. Specifically, academic emotions are "defined as affective arousal" (p. 121, Pekrun & Perry, 2014) that are "tied directly to achievement activities or achievement outcomes" (p. 15, Pekrun, Frenzel, Goetz, & Perry, 2007). Achievement/academic activities, for instance, could be taking notes in an English class for a Grade 4 student, sitting for a provincial test on mathematics for a high school student, or trying to make sense of what *homeostatic* means when studying for a biology chapter for a Grade 11 student. Pekrun and his colleagues elaborated that academic emotions are aroused and experienced because those academic activities are often subjected to evaluation and judgement either made by the student or others (e.g., teachers, peers, and parents).

In the theoretical framework proposed by Pekrun and his colleagues (2007, 2014), academic emotions are differentiated based on three dimensions: the focus of activity (i.e., the activity itself, the outcome of an activity which is further divided into prospective and retrospective), the valence of experience (i.e., a broad categorization into either a positive or negative emotion), and the level of activation (i.e., stimulating or inhibiting behavioural responses and motivation etc.). Sixteen emotions are listed: anger, anxiety, boredom, contentment, disappointment, enjoyment, frustration, gratitude, hope, hopelessness, joy, pride, relaxation, relief, sadness, and shame. The underlying mechanism for a given emotion experienced is related to cognitive appraisal in terms of control of and value in an academic-related activity (Pekrun et al., 2007). For example, if a student sees the importance and relevance to learn calculus in a math class and thinks that he/she is able to master this concept, this particular student will likely experience enjoyment while learning different types of calculus.

Definition of Boredom

More than six decades ago, Greenson (1953) described boredom as an experience associated with a negative attitude toward an activity, along with a reduction of physical actions, an inability to specify what one desires, a passive attitude hoping for a change from an external source, and a sense of time distortion. Although Greenson's description of boredom was based on case analysis, his work laid a foundation for later investigations that sought to systematically define boredom. For instance, Geiwitz (1966) concluded that boredom was related to "low arousal, increased feelings of unpleasantness, constraint, and repetitiveness" (p. 598). In recent years, Eastwood, Frischen, Fenske, and Smilek (2012) concluded that boredom is a negative emotion whereby one cannot meaningfully engage in a task, is unable to sustain required attention, and attributes an external environment as a cause of this aversive feeling. In spite of the effort to seek to identify what constitutes the experience of boredom, it is clear that a definition of boredom should also be grounded in a model or theoretical framework.

Russell (1980) built a model to explain and discriminate different emotions, including boredom. In the circumplex model, emotions are organized in a circular manner along two dimensions: pleasant-unpleasant and low arousal-high arousal, with boredom falling on the unpleasant and low arousal quadrant. This classification is supported by Vogel-Walcutt, Fiorella, Carper and Schatz's (2012) review of literature on boredom in education settings. In particular, the authors commented that boredom can be conceptualized as "an unpleasant and low-arousal" (p. 89) emotion. Although this conceptualization facilitates our understanding of boredom in relation to other emotions, it does not entail what constitutes boredom. O'Hanlon (1981) proposed that boredom should be "defined as a unique psychophysiological state [and it] comprises a set of interrelated emotional, motivational, and cognitive reactions having a common biological basis" (p. 76). In particular, the emotional component is a stressful state to overcome the typically low arousal state of being bored; the motivational component is referred to as high effort spent to maintain arousal; and the cognitive component is referred to as reduced attention due to a lower level of arousal. This multicomponent conceptualization of boredom (as well as other emotions) is echoed by Scherer (2009) who developed the component processing model (CPM) of emotions. The emphasis of CPM is on the integrated and recursive nature of various components: cognitive appraisal, feeling, motivation, and physiology responses (Scherer, 2009).

With regard to boredom in achievement settings, Pekrun and his colleagues (2010) took a similar approach when defining boredom: "[it] consists of specific affective components (unpleasant, aversive feelings), cognitive components (altered perceptions of time), physiological components (reduced arousal), expressive components (facial, vocal, and postural expression), and motivational components (motivation to change the activity or to leave the situation)" (p. 532). They also incorporated the two-dimensional model into their conceptualization of achievement boredom: [it] is [also] categorized as a negative, deactivating emotion, because it is experienced as unpleasant and involves a reduction of physiological activation" (p. 532), and boredom is expected to be experienced during an academic-related activity when a student perceives a lack of value in, coupled with either an overwhelming high control or lack of control over, a given achievement task (e.g., Pekrun et al., 2007, Pekrun & Perry, 2014). In addition, Pekrun et al. (2010) explained that academic boredom is not a synonym of lack of interest, with the difference being that the former involves a deactivating motivational component and negative affect, whereas the latter does not imply an avoidance motivation and is a neutral affective state. Such an integration of conceptualizations thus facilitates our understanding of what boredom is.

Effects of Being Bored: Negative or Potentially Beneficial?

In the literature and among folk beliefs, there exist two different perspectives regarding consequences that arise when an individual is bored. As Belton (2008) discussed, one camp suggests that boredom would lead to negative consequences, for example, lowering intrinsic motivation (Pekrun et al., 2010), impeding academic attainment (Daniels et al., 2009), and leading to a heightened suspension rate in gifted students (Kanevsky & Keighley, 2003). However, there is a counter-argument suggesting potential benefits of being bored (Belton, 2008). For instance, Bench and Lench (2013) argued that boredom indeed signals an individual to make changes, given that the current activity and goal are no longer motivating. Mann and Cadman (2014) furthered this line of argument and found that individuals became more creative after being exposed to boring conditions (i.e., coping and reading telephone numbers) than those who were in a control condition. However, few studies have investigated the advantages of boredom, and most of these studies investigated boredom experienced in non-academic situations.

Purposes of This Dissertation

In spite of growing attention paid to boredom in educational settings, there is still a gap in understanding this emotion in students' educational journeys. Therefore, in order to advance our understanding of academic boredom, this dissertation includes three articles on the topic.

The first article (Tze, Daniels, & Klassen, 2014a) uses meta-analytical technique to investigate the overall effect size between academic boredom and students' learning outcomes, including motivation, study strategies and behaviours, and academic attainment. Although the *effect* of boredom has received some attention, there is not yet a systematic analysis of empirical studies on this topic. Therefore, a thorough quantitative review of existing literature on the effect of boredom on learning advances our current understanding with regard to the influence of academic boredom.

The second article (Tze, Klassen & Daniels, 2014) evaluates the longitudinal interrelationships between perceived autonomy support, academic boredom, and engagement through one semester. Most empirical studies have measured boredom at only one time period and, consequently, there is a gap in understanding the pattern of change in academic boredom and student engagement over a longer period of time. Using a multi-wave design and measuring the same set of constructs over time allows us to measure how boredom and student engagement change simultaneously. Furthermore, perceived autonomy support is examined to see the influence of this theoretically supported antecedent on change of boredom in an authentic learning situation.

Finally, the third empirical article (Tze, Daniels & Klassen, 2014b) investigates the validity of a scale assessing the precursors of academic boredom. The scale includes eight empirically supported antecedents: monotony, lack of meaning, opportunity costs, being over-challenged, being under-challenged, lack of involvement, teacher dislike, and general boredom tendency (Daschmann, Goetz, & Stupnisky, 2011). In addition, the extent to which these eight precursors are related to self-efficacy for self-regulated learning and achievement are investigated.

Taken together, this three-article dissertation not only provides a systematic review and analysis of the academic boredom literature but also advances understanding of the causes, patterns, and influences of boredom. Despite the focus on a negative emotion, implications for teachers and students to manage boredom are discussed in all three articles.

Footnote

[1] The terminology for each basic emotion reported here was chosen based on how often the term is used among four basic emotions research teams. Specific terminologies used by individual researchers can be found in Tracy and Randles (2011).

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CHAPTER TWO: EVALUATING THE EFFECTS BETWEEN ACADEMIC BOREDOM AND LEARNING: A META-ANALYSIS (Tze, Daniels & Klassen, 2014)

Introduction

Emotion has been an important topic of study in educational research in the past two decades (e.g., Verma & Nijhawan, 1984; Venn & Short, 1973; Onwuegbuzie, 1997; Pekrun, Goetz, Tiz, & Perry, 2002; Vogel-Walcutt, Fiorella, Carper, & Schatz, 2012), and the scope of emotions receiving empirical attention has greatly increased. For example, Pekrun and colleagues' 2002 review of students' emotions and achievement identified more than 1,200 studies that focused on anxiety, but there were only 43 studies on boredom. A quick search in PsychINFO shows that research interest in boredom is increasing, but boredom can still be considered a relatively un-studied "silent emotion" in comparison with other emotions, such as anxiety (p. 531, Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010). Many recent studies have relied on Pekrun and colleagues' framework which identified nine *academic emotions* (i.e., enjoyment, hope, pride, relief, anger, anxiety, hopelessness, shame, and boredom). Among these emotions, boredom has been shown to be commonly experienced by students in schools.

Theoretical Framework of Boredom

Academic boredom is a multidimensional negative emotion, involving four interrelated components: cognitive (e.g., mental inertia), affective (e.g., unsettling feelings), motivational (e.g., inclination to avoid a boring situation), and physiological (e.g., low physical arousal) (Pekrun, Goetz, Frenzel, Barchfeld, & Perry 2011; Tze, Klassen, Daniels, Li, & Zhang, 2013). This conceptualization also aligns with the valence-activation framework of emotion (e.g., Russell, 1980) and the component processing model (Scherer, 2009), indicating that boredom experienced in academic-related settings is unpleasant and deactivating, and involves different facets of expression. To undertake research in boredom, it is important to position this work within the theoretical understanding of academic emotions. Pekrun's (2006) control-value theory therefore provides a conceptual understanding of academic boredom regarding its relationships to students' learning outcomes.

Control-Value Theory

To fully understand academic emotions, Pekrun (2006) developed a control-value theory of emotion, depicting the relationships between emotions experienced in achievement situations. In this framework, boredom is conceptualized as an activity emotion that is experienced by students during an ongoing activity (e.g., studying), and researchers have found negative associations between academic boredom and a multitude of learning outcomes and consequences (i.e., achievement). Pekrun (2006) and his colleagues (2002, 2010) provide a thorough discussion of how and why boredom negatively affects a range of cognitive and motivational components in learning and subsequently achievement. For example, boredom may reduce students' motivation and persistence in learning. As the authors argue, the deactivating nature of boredom may also lead to inattention and superficial learning patterns. Because learning requires the use of cognitive resources and attention on tasks, when students feel bored in academic-related circumstances (e.g., listening to lectures), they may be distracted from the learning tasks (e.g., daydreaming); this reduces their available cognitive resources for learning. Such a distraction may in turn negatively affect students' achievement. The control-value theory thus provided a solid conceptualization to understand the relationship between boredom and learning; this may be of particular interest to researchers and educators, in light of the potential negative effects on students' learning and achievement.

Academic Boredom as a Common Emotion Experience

Although general boredom has been researched for more than 25 years (Farmer & Sundberg, 1986), most studies (e.g., Harris, 2000) have focused on general boredom proneness and evaluated the impact of general boredom on students' behaviours. In the past ten years research focusing specifically on academic boredom has received more attention (e.g., Pekrun et al., 2002, 2010; Tze, Klassen et al., 2013). As Pekrun and his colleagues (2002) note, academic boredom refers to the feelings of boredom "that are directly linked to academic learning, classroom instruction and achievement" (p. 92). For instance, Mann and Robinson (2009) found that 58% of college students in England reported that more than half of their lectures were boring. Our own research has found that about 26-41% of undergraduate students in Canada and almost 50% of those in China reported being bored in class at some point (Daniels, 2010; Tze, 2011). Similarly, in Daschmann, Goetz, and Stupnisky's study (2011), more than 44% of German middle school students were at least partly bored in class. Larson and Richards (1991) found that middle school students in the United States described about 40% and 36% of their homework time and classwork time, respectively, as boring.

Not only do students in general education classes experience boredom, but students with special education needs (e.g., giftedness and learning disabilities) may also feel bored. Preckel, Götz, and Frenzel (2010) found that both regular and gifted students in Australia reported similar frequencies of boredom over an academic year, although the former were more bored due to being over-challenged, whereas the latter were mainly bored by under-challenging activities. In addition, Woolf et al. (2010) found that low-achieving pupils and students with learning disabilities in the United States reported higher levels of boredom in learning mathematics than did high-achieving students. Furthermore, boredom is also reported by students from other cultures. For example, in Tze, Klassen et al.'s (2013) study, boredom during studying and in class was evident among Chinese university students. In Vandewiele's (1980) study, about 22% of Senegalese adolescents reported feeling bored in school. Jang, Reeve, Ryan, and Kim (2009) found that Grade 9 Korean students stated that being bored was one of their unsatisfying learning experiences. These empirical findings thus suggest that boredom in educational contexts seems to be a universal academic emotion, frequently experienced by students across age groups, educational needs, and ethnicity.

Influences of Boredom on Academic Outcomes

According to Pekrun's (2006) control-value theory, boredom, as an academic emotion, is expected to influence learning and achievement. Boredom specific to school settings was examined as early as the mid-twentieth century (e.g., Kooker, 1959). Kooker examined the effects of boredom on students' behaviours, and found that the more bored primary school students were in schools, the more frequently they arrived at school late. Given that school attendance is important to learning, it is reasonable to speculate that this may lead to adverse effects on their learning.

Empirical evidence regarding the negative effects of boredom, such as distress (Barnett, 2005) and juvenile delinquency (Newberry & Duncan, 2001), has accumulated in the past decades, and most of the studies focused on the relationships between general life boredom (e.g., boredom proneness, Farmer & Sundberg, 1986; and leisure boredom, Wasson, 1981) and school behaviours (e.g., deviance; Wasson, 1981, and truancy, Sommer, 1985). Although these studies facilitate our understanding on general life boredom and leisure boredom, there is still a research gap in understanding boredom specific to school settings. As Vogel-Walcutt et al. (2012) note, "boredom [within academic settings] is more amenable to environmentally based mitigation strategies . . . methods to target and alleviate state boredom has the potential to be of considerable value to educators and may ultimately improve student performance (Belton [&] Priyadharshini, 2007)" (p. 90). Although Vogel-Walcutt et al. provided a thorough review of studies of boredom within educational settings, their article focused on qualitatively describing the nature of state boredom and lacked a quantitative synthesis of the effects of boredom on learning in the literature.

Researchers have identified negative relationships between academic boredom and multiple learning factors, such as self-efficacy for self-regulated learning, effort, and course grade (e.g., Daniels et al., 2008; Pekrun et al., 2011; Tze, Daniels, Klassen, & Li, 2013). Artino (2009) assessed the extent to which boredom relates to learning strategies in a single episode and found negative relationships with elaboration, $r = -.28$, and metacognition, $r = -.35$. Similarly, Tze, Klassen et al. (2013) found a negative association between academic boredom and self-efficacy for self-regulated learning in both Chinese and Canadian university student samples. In a recent longitudinal study, Tze, Klassen, and Daniels (2014) also found negative association between boredom and students' engagement. In order to examine the possible causal influence of boredom on learning and achievement, some studies have tried to account for temporal difference when measuring these two constructs (Daniels et al., 2009; Pekrun et al., 2010). For instance, Daniels and her colleagues found a negative impact of being bored on academic attainment among university students. Although Harris (2000) found that 44% of college students in the United States perceived that being bored provided them with an opportunity for reflection and concluded it as one of the potential positive aspects, there is a lack of theoretical support for the claim. Similarly, despite Vodanovich's (2003) review of possible benefits of being bored, such as motivating one to produce creative work and enhancing one's introspection, there is not much empirical evidence supporting positive effects of boredom. Hence, it is important to synthesize research findings that explore the relationships between academic boredom and students' learning outcomes.

Impacts on Different Academic Outcomes

Prior studies have examined the relationships between boredom and multiple learning factors, such as intrinsic motivation, effort, elaboration, rehearsal, and performance (Pekrun et al., 2011; Tze, Klassen et al., 2013). Based on Pekrun's (2006) control-value theory, most of these learning variables can be categorized into motivation, strategies/regulation, and achievement. Although there is an additional category/learning factor—cognitive resources—specified in the theoretical framework, it has received much less attention in empirical work compared to the other three factors. This in part may be due to an assumption that a majority of emotional experiences, including boredom, lower cognitive resources available for learning tasks (Pekrun), implying less distinctive influence from each academic emotions on this attribute. In addition, the investigation into the effects of boredom on cognitive resources might be more methodologically challenging than assessing the remaining three factors. Assessment of cognitive resources might require the use of neurological and physiological equipment and/or behavioural trackers, as was discussed in Vogel-Walcutt et al. (2012) regarding the assessment of boredom, in classroom settings, which poses large logistical issues. It is therefore not surprising to observe that empirical studies have focused on assessing students' motivation, use of strategies, and achievement and their relations with academic boredom. In Stavrova and Urhahne (2010), the higher levels of boredom eighth and ninth graders reported, the lower their intrinsic motivation to learn was. In light of these empirical findings, it appears logical to examine the association between boredom and the aforementioned three learning factors (i.e., motivation, use of strategies, and achievement).

Boredom Experienced in Different Academic Contexts

In the control-value theoretical framework, academic boredom is classified as an activity emotion in which "the attentional focus is on the action" (p. 319, Pekrun, 2006). There is a myriad of academic-related "actions" in which boredom can be aroused, such as listening to a lecture, working on an in-class writing task, conducting a hands-on experiment, preparing for a coming class, reading through class notes, and studying for exams. This list of academic activities can go on and on. Instead of focusing on each individual activity, researchers often examine how boredom is experienced in a broader category of action. For instance, in Mann and Robinson's (2009) and Larson and Richard's (1991) studies, the focus was on how often students reported being bored *in class*, and in Tze, Klassen et al. (2014) study, the emphasis was about how students' experience of boredom in class changed over time. Another category of academic-related activities that has received researchers' attention is *studying/learning*. For example, Fritea and Fritea (2012) investigated students' level of boredom when studying for Romance. Similarly, Tze, Klassen, et al. (2013) examined the intensity of boredom when university students studied for their courses in Canada and China. These two types of experiences—class-related boredom and boredom experienced during studying— could be related in part to learning environments, such as didactic and teacher-centered lecturing, and/or to cognitive appraisals of the situations, such as not finding meaning in studying (e.g., Pekrun, 2006). Specifically, Pekrun and his colleagues (2011) found a high correlation, $r = .73$, between class-related and learning-related boredom. Despite this strong correlation, learning-related boredom was negatively related with academic control, motivation, use of learning strategies, and achievement to a greater extent than was class-related boredom. A third category of activity in which boredom may be experienced is testing. In the literature, there were only three studies evaluating pupils' level of boredom during a test. Goetz and his colleagues (2007) assessed the experience of boredom in a group of elementary students during a mathematics test. Similarly, Asseburg and Frey measured Grade 9 students' level of boredom when they were taking a mathematics test. Although Ahmed, van der Werf, Kuyper, and Minnaert's (2013) study included items measuring levels of boredom during math tests, they were aggregated with items assessing boredom experienced in class and while studying.

Although it appears that the former two categories of academic-related actions (i.e., class-related and learning-related boredom) received more attention in the boredom literature than the third one—boredom experienced during tests—there is still a lack of a systematic analysis investigating whether boredom experienced in class has a more negative relationship with students' learning than boredom experienced during studying.

The Effect of Boredom on Academic Outcomes Across Ages

Although academic boredom can be considered a universal emotion across ages, age may, in part, have some influence on this affective experience (e.g., Larson & Richards, 1991). In Larson and Richards' study, about 36% of middle school students reported their classwork time as boring. Although no significant difference in boredom across grade levels (Grade 5 to 9) was found, a growing trend of reported boredom emerged between Grades 5 and 8; levels of boredom decreased beginning in Grade 8. A mixed result was found in Goetz, Cronjaeger, Frenzel, Lüdtke, and Hall's (2010) study. Eighth-graders reported higher mean levels of boredom in mathematics and German than did eleventh-graders, whereas Grade 11 students reported a higher mean level of boredom in Physics than did their Grade 8 peers. Interestingly, there was no statistical difference in their mean level of boredom in English. Among university students, Mann and Robinson (2009) found that 58% of university students reported being bored in more than half of their lectures, whereas only 35% of college students in Harris's study (2000) indicated that they were bored by lectures. In view of these results, it is important to take age into consideration when examining academic boredom and its effects.

Purposes of Current Study

A review of relevant boredom studies supports the notion that boredom is a negative and deactivating emotion, but no synthesis of empirical findings examining the relationship between boredom and academic outcomes has been conducted. The first purpose of this study was therefore to examine the magnitude of the relationships between students' academic boredom and outcomes (an aggregation of motivation, learning strategies and behaviours, and achievement). Based on the past literature (e.g., Kooker, 1959, Pekrun et al., 2002, 2010), it is hypothesized that academic boredom would be negatively related to students' learning. The second purpose of this study was to explore potential moderator effects on the relationship between boredom and students' motivation, adaptive learning strategies and behaviours, and achievement.

Method

Data Collection

Study collection. Multiple search strategies were used to identify relevant studies. First, we searched published articles and dissertations in online databases, including PsycINFO, Web of Science, and the Educational Resources Information Center (ERIC). To reduce publication bias (Rothstein, Sutton, & Borenstein, 2005), the search also included dissertations in ProQuest Dissertations and Theses. We used the keyword *boredom* and its variations (*bored* and *boring)* along with the linking terms *learning*, *motivation*, *performance* and *achievement*. In addition, a second keyword—*emotions*—and the combination of the aforementioned linking terms were used in the search. The database search had no date restriction, aiming to locate all relevant studies. Second, we searched key journals, including the *Journal of Educational Psychology*, *British Journal of Educational Psychology*, *Learning and Instruction*, *Contemporary Educational Psychology*, *Learning and Individual Differences*, *Educational Psychologist*, *Journal of Learning Sciences*, and *Journal of Experimental Education*. Third, we reviewed the reference lists of all studies identified in order to locate additional published articles. Fourth, we sent e-mail requests to 19 authors of previously identified studies, aiming to locate further unpublished studies or dissertations. The search was completed in early 2014.

Inclusion criteria. To be included in the meta-analysis, a study had to meet the following criteria: (a) have a measure of academic or achievement boredom, (b) indicate how boredom is measured (e.g., a sample item), (c) include a measure of students' learning strategies and behaviours, motivation, or performance, and (d) provide sufficient information to calculate effect sizes. In addition, the following four exclusion criteria were applied to refine the sample of studies identified. First, studies had to be written in English. Second, case studies and qualitative studies were excluded. Third, studies using bipolar scales to measure academic or achievement boredom were excluded. Fourth, measures of academic boredom had to be administered at the same time or prior to measures of learning strategies and behaviours, motivation and performance.

Plan of Analysis

Coding process. Each of the retrieved studies that met the inclusion criteria was coded for the year of publication, sample size, sample characteristics (e.g., gender and age), subject matter, types of measures, and the magnitude of the relationship between boredom and learning measures. Two independent raters coded two-thirds of the selected studies for descriptive and statistical values reported, achieving an intra-class correlation of .99 when coding was compared. Discrepancies were discussed and resolved, and 100% agreement was achieved. The remaining third of the studies was then coded by one of the raters.

Calculating effect sizes. We used the MIX 2.0 computer program (Bax, 2012) to conduct the analysis. Effect sizes, in terms of Pearson *r*, were calculated. If an effect size could not be estimated due to missing and/or insufficient data, the study was excluded from the subsequent analysis. In cases in which studies reported multiple correlations between boredom and learning factors, we computed an average effect size for multiple results (e.g., boredom and achievement in Physics, and boredom and achievement in English within a study) in order to minimize violation of the assumption of independence (e.g., Lipsey & Wilson, 2001). The average effect size was then weighted based on the corresponding study's standard error. Given that Person *r* to Fisher's *z* transformation is suggested in conducing meta-analysis on *r* (e.g., Borenstein, Hedges, Higgins, & Rothstein, 2009), the transformation procedure was used in this meta-analysis.

To compute the overall effect size of the sample of studies, a more conservative random effects statistical model was used. The random effects statistical model assumes heterogeneity of population effects, which appears to be more appropriate than the fixed effects model assuming homogeneity of population effects, given that the relationships between boredom and learning varies across studies. After calculating the overall effect size, the selected studies were disaggregated to examine potential moderating effects. For example, for age effect, studies reporting separate data on different age groups were aggregated to evaluate this moderator effect.

Assessing publication bias. To evaluate whether the results were biased, we conducted Rosenthal's fail-safe *N* test, which calculates the number of studies with non-significant results needed to bring the significant level down to $p = .05$. Additionally, we performed Begg's regression test (Begg & Mazumdar, 1994) to examine whether or not publication bias presents in this sample of studies. A funnel plot was also provided to visually examine publication bias.

Results

Main Effect Size Analysis and Publication Bias Evaluation

A total of 35 independent effect sizes from 29 empirical studies, involving 19,052 student participants, were included in the meta-analysis. Table 2.1 shows sample sizes, originally reported statistics, effect size, and 95% confidence intervals for each independent sample. The overall effect size, $\overline{r} = -.24$, was significant at $p < .001$ and was considered to have a small-medium magnitude (when converted to Cohen's $\overline{d} = -.50$) according to Cohen's guidelines (Cohen, 1988). The overall negative effect size indicates a negative relationship between academic boredom and outcomes. Figure 2.1 shows a synthesis plot with a point estimate of individual effect size (represented by the square) and its confidence intervals (represented by the horizontal line across the square). The overall estimated effect size and 95% confidence intervals are represented by the centre and the width of the diamond, respectively. Furthermore, the significant $Q(34) = 246.48$, $p < .001$, indicates a heterogeneity of effect sizes, suggesting the need to explore subgroup (moderator) effects, using Q_b statistic.

In order to test for publication bias, we examined the funnel plot (see Figure 2.2), which provided a visual indication of whether publication bias exists in this overall effect size estimation. The scatterplot formed an asymmetric funnel, indicating potential bias that required a more in-depth investigation. Given the subjectivity involving in interpreting a funnel plot, we used Begg's regression test (Begg & Mazumdar, 1994) to further examine the possibility of publication bias. The result showed that tau b = -.10, $p > .05$, suggesting that publication bias was not a major concern. Lastly, we performed Rosenthal's (1979) fail-safe *N* analysis to estimate the number of studies with non-significant results that are needed to bring the significance finding to $p = .05$. The results suggested that an additional 34,400 missing studies with an average zero effect size would be needed to reduce the significance to $p = .05$. Overall, these results indicated that the study results may not be influenced by publication bias.

Moderator Analyses

Type of academic outcomes. Given that academic outcomes can take many forms, such as motivational and behavioural variables, we examined a moderating effect in terms of academic motivation ($k = 16$), study strategies andbehaviours ($k = 14$), and achievement ($k = 21$). Significant heterogeneity in effect sizes among the three groups was found, Q_b (2) = 384.36, $p < .001$. All three effect sizes were significant, $\overline{r}_{\text{motivation}} = -.40$, $\overline{r}_{\text{strategies}} = -.35$, $\overline{r}_{\text{achievement}} = -.16$, *ps* < .01, as shown in Table 2.2. The greatest negative effect size was found with student academic motivation, followed by study strategies andbehaviours, and achievement. Post-hoc analysis revealed that the three groups significantly differed from one another, *p*s < .001.Furthermore, the effect sizes of motivation and study strategies and behaviours were significantly more negative than that of achievement, *p*s <.001.

Contexts in which academic boredom is experienced. We computed 22 effect sizes for the comparison between class-related boredom and learning-related boredom, and because of a lack of studies examining boredom during exams and tests, this particular situation was not included in the moderator analysis. The effect sizes were from 16 empirical studies, given that a study can contribute to both class-related and learning-related boredom. The class-related boredom group included eight effect sizes, and the learning-related boredom group was comprised of 14 effect sizes. The between-group comparison was significant, $Q_b(1) = 5.48$, $p = .02$. In this moderator analysis, class-related boredom, $\overline{r}_{class} = -.33$, $p < .001$, was significantly more related to lower levels of academic outcomes than learning-related boredom, $\overline{r}_{learning} = -.26$, $p < .001$.

Age groups. Based on common schooling categories, the overall effect sizes were disaggregated and regrouped into two age groups (i.e., secondary and tertiary). The secondary level group consisted of 7, and the university/college level group included 27. The two groups showed significant negative effect sizes, $\overline{r}_{secondary} = -.26$, $\overline{r}_{tertiary} = -.23$, *p*s < .05, consistent with the overall direction of the main analysis, and the between-group comparison was significant, $Q_b(1) = 37.72$, $p < .001$, indicating differences in the magnitude of the relationship between academic boredom and outcomes between the two age groups. In other words, the effects of academic boredom had greater impact on secondary students' motivation, adaptive learning behaviours, and performance than on college students' academic outcomes.

Discussion

This meta-analysis of 29 studies, involving 19,052 students, evaluated the strength of the negative association between boredom and students' academic outcomes (i.e., academic motivation, learning strategies and behaviours, and achievement), which is the primary contribution of this study. In addition, this meta-analysis explores three moderators, namely types of academic outcomes, categories of academic-related activities, and age groups, and evaluates the extent of which the detrimental effect of boredom may hold true under the above specific circumstance.

An Overall Negative Effect Between Boredom and Academic Outcomes

Although there has a discussion regarding possible benefits of being bored (Bench & Lench, 2013; Gana, Deletang, & Metais, 2000; Vodanovich, 2003), our findings revealed a significant and modest negative overall relationship between boredom and academic outcomes, $\overline{r}$ = -.24, which is in line with the contemporary theoretical understanding of academic boredom (Pekrun, 2006) and prior qualitative review (Vogel-Walcutt et al., 2012) of this emotion. This pattern of results may also be explained by the types of contexts—academic vs non-academic—in which boredom is experienced (Goetz et al., 2014). In Goetz and his colleagues' study, types of boredom, which have a negative valence, were more likely to be reported when students were performing academic-related activities than when they were engaging in non-academic tasks. Given the unpleasantness of boredom experienced in academic-related settings (which was the focus of the present study), it is not unexpected to see its negative correspondence with adaptive academic functioning and behaviours.

Differential Influence of Being Bored on Academic Outcomes

Our finding about the magnitude of the associations between academic boredom and the three types of academic outcomes supports Pekrun's (2006) theoretical conceptualization of emotions, and particularly his ideas about the proximity between boredom and different components in learning. Moderate effect sizes were found between boredom and motivation, $\overline{r}_{\text{motivation}}$ = -.40, and between boredom and study strategies andbehaviours, $\overline{r}_{\text{strategies}}$ = -.35. One possible explanation for this difference in the magnitude of association may be: being bored results in lower motivation to learn (motivation is in close proximity to boredom), and lower motivation in turn may lead to physical disengagement from learning situations (study strategies andbehaviours are relatively farther from boredom). The results may be also related in part to the multidimensional nature of boredom, including the affective, cognitive, motivational, and physiological components (Pekrun et al., 2011), whereby academic boredom may capture a part of students' motivation in learning (e.g., "Because I'm bored I have no desire to learn"; Pekrun et al., 2002; Pekrun, Goetz, & Perry, 2005). By contrast, the use of varying study strategies and behaviours represents distinct behavioural patterns, which may not be captured in the multidimensional nature of boredom, and yet indicates an important finding with respect to the influence of boredom on students' learning behaviours. Not only were the effect sizes of motivation and study strategies andbehaviours subgroups significantly different from each other in terms of their relationships with boredom, their effect sizes in both cases were greater than the boredom-achievement relation, $\overline{r}_{\text{achievement}} = -.16$. The results are indeed consistent with Pekrun's (2006) conceptualization of the relationships among academic emotions, learning, and achievement. As Pekrun notes, emotions influence academic motivation and behavioural strategies used in learning, which in turn affects academic performance.

A More Negative Effect of Being Bored in Class Than During Studying

The meta-analytical results reveal that the type of boredom significantly moderated the relationships. In other words, class-related boredom has a more significant negative association with student academic outcomes, $\overline{r}_{\text{class}} = -.33$, than does learning-related boredom, $\overline{r}_{\text{learning}} = -.26$. This result might be related to students perceiving a greater extent of lack of a perceived control in class than during studying. When students get bored in class, they may have limited means (e.g., reappraising the importance and daydreaming) to cope with this emotion, in part due to physical constrain of the setting and on-going teaching and learning of other students in the class. By contrast, when a student is studying, he or she could employ a wider range of solutions that may not be available in a classroom setting, such as taking a short movement break and reading a chapter at a more appropriate level. Hence, feeling bored in a class or course appears to have greater (negative) association with the learning process and achievement.

A Greater Negative Effect Among Secondary School Students

In addition to types of academic outcomes moderating the strength of association, the results indicate the transition from secondary to college education may reduce the association between academic boredom and academic outcomes. We found a significantly greater strength in the boredom-learning association among secondary students, $\overline{r}_{\text{secondary}} = -.26$, than among post-secondary students, $\overline{r}_{\text{tertiary}} = -.23$, $p < .001$. One possible explanation is that university students have more autonomy in choosing their programs of study and flexibility in building their course schedules. In such a learning context, post-secondary students have more control over their learning activities than secondary students who have to, more often than not, follow less flexible educational curricula in order to graduate. Hence, in a less autonomous learning environment, the negative association between boredom and learning may therefore be augmented.

Limitations

Although this study is limited by a relative small sample size, the patterns of results are generally consistent across studies, with more than 85% of independent effect sizes in the expected (negative) direction, and there is no apparent indication of publication bias. However, the small sample size also clearly indicates the paucity of research on academic boredom. In addition, the present study does not include some important moderator analyses (e.g., trait versus state academic boredom, and elementary students) because of the limited number of studies reporting and/or investigating those effects. Furthermore, although the main analysis meets the independence assumption in meta-analysis, some data were lost due to the aggregation of multiple outcomes. Lastly, most of the primary studies were conducted in North American and

European settings, limiting the generalizability of findings to other cultural groups (e.g., South East Asian).

Implications

The findings of the present study reveal (a) the extent to which academic boredom is related to students' academic outcomes; (b) the differential effect of age groups on the above relationship; and (c) the influences of academic boredom on student's motivation, use of study strategies and behaviours, and achievement. The overall negative relationship, $\bar{r}$ = -.24, between academic boredom and academic outcomes provides some support for the detrimental effects of being bored in academic-related situations. Despite the small-medium magnitude of the overall effect size, as Coe (2002) notes, an effect size as small as d = .10 (equivalent to r =.05) is meaningful in educational contexts given the accumulated effects over time on students' academic attainment. In addition, Freugon (2009) suggests r = .20 as the "recommended minimum effect size" (p. 533) for practical utility. Given that experience of boredom in academic-related situations can accumulate over both short- (e.g., minutes and hours) and long- (e.g., days and semesters) period of time, coupled with at least a practically useful effect size magnitude between boredom and academic outcomes, our results indicate the importance of intervening this negative emotion.

For educators, it is important to design curriculum and learning contexts, and to provide quality instruction that may help to alleviate boredom. As Pekrun (2006) notes, a learning environment (e.g., task demands and feedback on students' attainment) entails distal factors that affect how students interpret their learning situations and emotions. Along the same lines, Daschmann et al.'s (2011) seven situational antecedents to boredom—being over-challenged, being under-challenged, being bored by an unchanging routine, not finding meaning in learning, having better things to do than be in class, disliking the teacher, and feeling uninvolved—can be the focus of intervention. For example, by providing optimal learning materials and instruction (i.e., neither far beyond and below students' capabilities to learn), academic boredom may be ameliorated, which in turn may help to improve students' learning. To complement educators' efforts, students should use strategies to better manage boredom in order to help them to improve their learning. For instance, the use of cognitive-appraisal strategies such as identifying meaning in a boring class, have been shown to be an effective approach to coping with academic boredom (e.g., Nett, Goetz, & Daniels, 2010; Tze, Daniels et al., 2013).

Although the magnitude of negative association between boredom and academic outcomes is stronger among secondary students than among college students, the results suggests that attention should be given to both groups of students. In light of the difference in cognitive maturity between students at the secondary level and those at the post-secondary level, the means to help ameliorate the negative influence of boredom on learning may thus be different. In secondary school settings, educators may take more responsibility in structuring learning environments and instilling the value of learning to help students to combat boredom. Given that post-secondary students likely are more motivated to learn and possess better cognitive abilities to re-appraise their learning situations, they may take more responsibility in employing adaptive strategies to tackle boredom. To this end, instructors at the post-secondary level can help their students by providing them with clear learning goals and differential instruction, that, in turn, may reduce potential to be bored in learning.

The results of this study also reveal that academic boredom has the greatest adverse impact on students' learning motivation, and their use of adaptive study strategies and their study behaviours, followed by its negative impact on achievement. This pattern of findings not only is congruent with the control-value theory (Pekrun, 2006) but also indicates the importance of preventing further negative impact on learning and achievement. Given the reciprocal nature of boredom and academic outcomes, students who are initially bored and become less motivated may “rejuvenate” their interest and lower their boredom by receiving support in identifying the value in taking a particular class, and by being offered opportunities to learn in ways that facilitate their learning. Thus, the differential impact of boredom on learning, as revealed in the findings, suggests potential avenues of intervention that can help to minimize the adverse impact of boredom on students’ overall academic achievement.

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Figure 2.1. Synthesis plot of included studies on boredom and learning

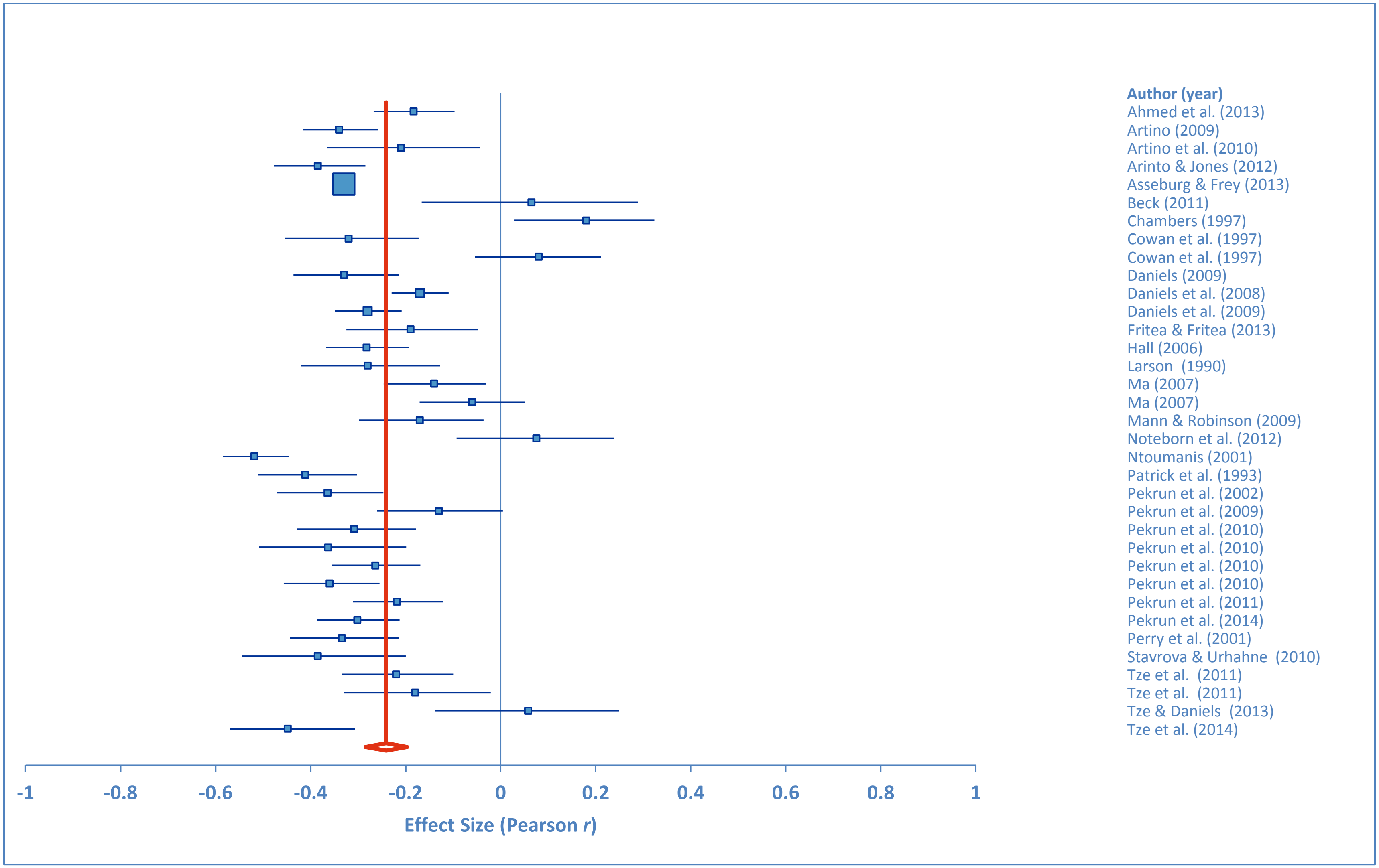

Figure 2.2. Funnel plot

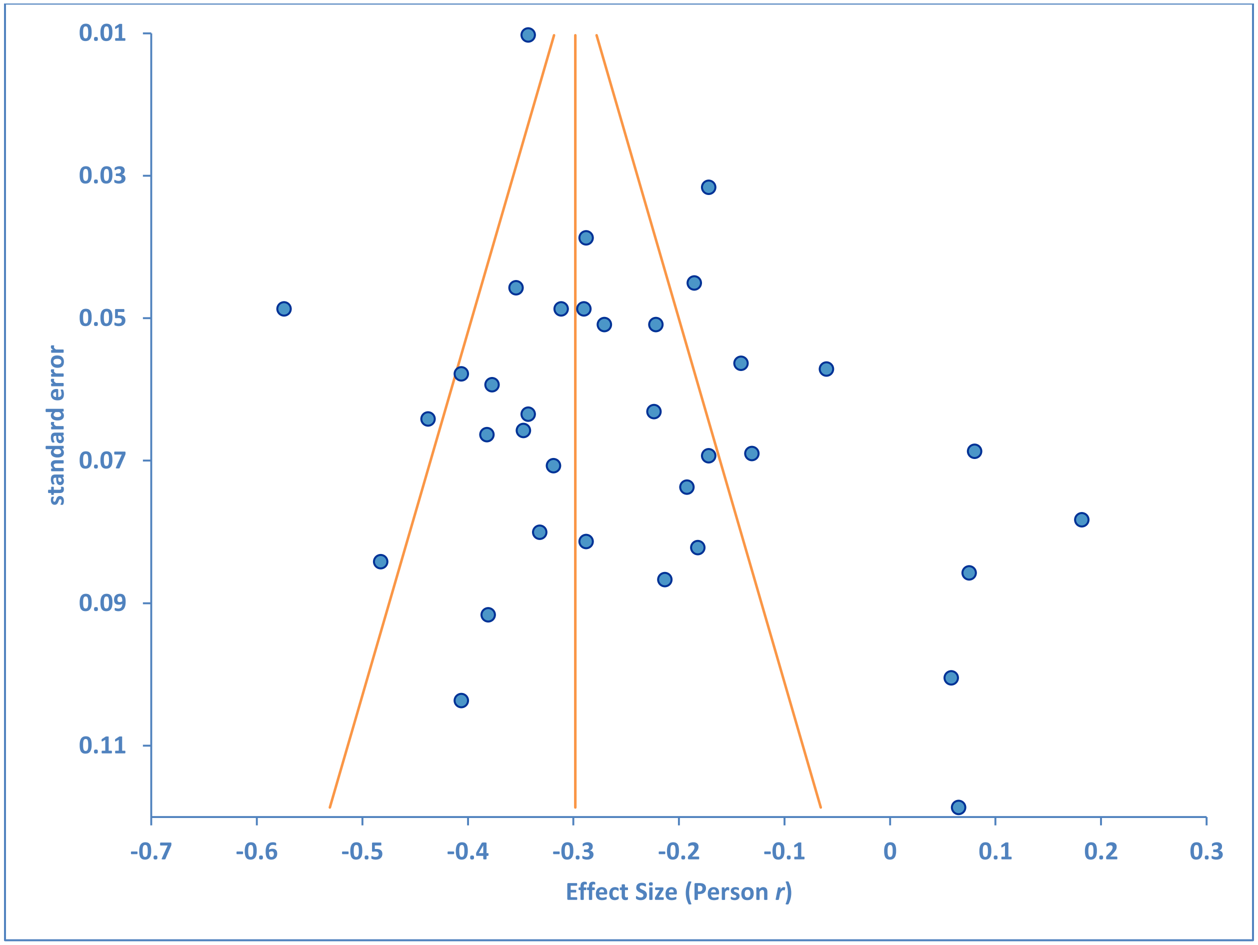

Table 2.1. A list of included studies: sample sizes, originally reported statistics, independent effect size and 95% CI

Study	N	Age	Situations	Originally Reported Statistics			Effect Size r	CI Lower Limit	CI Upper Limit
Ahmed et al. (2013)	495	Grade 7	Class-related + Learning-related + Test-related	Time 1	boredom <-> shallow strategies	*r* = -0.22	-0.18	-0.27	-0.10
					boredom <-> deep strategies	*r* = 0.07			
					boredom <-> meta-cognitive strategies	*r* = -0.22			
					boredom <-> achievement	*r* = -0.24			
				Time 2	boredom <-> shallow strategies	*r* = -0.23			
					boredom <-> deep strategies	*r* = -0.17			
					boredom <-> meta-cognitive strategies	*r* = -0.18			
					boredom <-> achievement	*r* = -0.16			
				Time 3	boredom <-> shallow strategies	*r* = -0.24			
					boredom <-> deep strategies	*r* = -0.15			
					boredom <-> meta-cognitive strategies	*r* = -0.2			

				boredom <-> achievement	r = -0.26			
Arinto & Jones (2012)	302	Undergraduate	Course-related	boredom <-> elaboration	r = -0.37	-0.385	-0.48	-0.28
				boredom <-> metacognition	r = -0.4			
Artino (2009)	481	Undergraduate	Course-related	boredom <-> self-efficacy	r = -0.27	-0.34	-0.42	-0.26
				boredom <-> elaboration	r = -0.28			
				boredom <-> metacognition	r = -0.35			
				boredom <-> continuing motivation	r = -0.46			
Artino et al. (2010)	136	Medical Students	Course-related	boredom <-> course exam grade	r = -0.26	-0.21	-0.37	-0.04
				boredom <-> NBME shelf exam score	r = -0.16			
Asseburg & Frey (2013)	9452	Grade 9	Test	boredom <-> effort	r = -0.44	-0.33	-0.35	-0.31
				boredom <-> math performance	r = -0.22			
Beck (2011)	74	Medical Students	Class-related + Learning-related	boredom <-> exam	r = 0.065	0.07	-0.17	0.29
Chambers (1997)	166	Middle school (11-14)	Unspecified	boredom <-> cumulative GPA	r = 0.18	0.18	0.03	0.32

Cowan et al. (1997)	159	Undergraduate	Unspecified		boredom <-> exam score (general studies student)	*r* = -0.32	-0.32	-0.45	-0.17
	215	Undergraduate	Unspecified		boredom <-> exam score (science-related majors)	*r* = 0.08	0.08	-0.05	0.21
Daniels (2009)	251	Undergraduate	Learning-related		boredom <-> final grade	*r* = -0.33	-0.33	-0.44	-0.21
Daniels et al. (2008)	1002	Undergraduate	Unspecified		Boredom <-> course grade	*r* = -0.22	-0.17	-0.23	-0.11
					boredom <-> GPA	*r* = -0.12			
Daniels et al. (2009)	669	Undergraduate	Unspecified		Boredom <-> course grade	*r* = -0.38	-0.28	-0.35	-0.21
					boredom <-> GPA	*r* = -0.18			
Fritea & Fritea (2013)	187	Grade 7	Learning-related		boredom <-> achievement	*r* = -0.19	-0.19	-0.32	-0.05
Hall (2006)	424	Undergraduate	Learning-related	Time 1	boredom <-> test performance	*r* = -0.23	-0.28	-0.37	-0.19
				Time 2	boredom <-> test performance	*r* = -0.38			
				Time 3	boredom <-> test performance	*r* = -0.28			
				Time 4	boredom <-> test performance	*r* = -0.22			
				Time 5	boredom <-> test performance	*r* = -0.3			
Larson (1990)	154	Grades 10-11	Unspecified		boredom <-> overall product quality (rated by a teacher)	*r* = -0.3	-0.28	-0.42	-0.13
					boredom <-> overall product quality (rated by an independent	*r* = -0.26			

				rater)			
Ma (2007)	318	Undergraduate	Unspecified	boredom <-> intention for future activity (American sample)	*r* = -0.14	-0.14	-0.25	-0.03
	309	Undergraduate	Unspecified	boredom <-> intention for future activity (Chinese sample)	*r* = -0.06	-0.06	-0.17	0.05
Mann & Robinson (2009)	211	University students	Class-related	time in lectures as boring <-> lecture time missed	*r* = -0.17[#]	-0.17	-0.30	-0.04
Noteborn et al. (2012)	139	Undergraduate	Learning-related	boredom <-> exam grade	*r* = -0.08	0.08	-0.09	0.24
				boredom <-> group assignment score	*r* = 0.23			
Ntoumanis (2001)	424	14-16 years old	Unspecified	boredom <-> amotivation	*r* = -0.59[#]	-0.52	-0.58	-0.45
				boredom <-> external regulation	*r* = -0.41[#]			
				boredom <-> introjected regulation	*r* = -0.18			
				boredom <-> identified regulation	*r* = -0.58			
				boredom <-> intrinsic motivation	*r* = -0.65			
				boredom <-> effort	*r* = -0.7			
Patrick et al. (1993)	246	Grades 3-5	Class-related	boredom <-> behaviours	*r* = -0.64	-0.41	-0.51	-0.31
				boredom <-> external regulation	*r* = -0.38[#]			

					boredom <-> introjected regulation	*r* = -0.22[#]			
					boredom <-> identified regulation	*r* = -0.36			
					boredom <-> intrinsic motivation	*r* = -0.4			
					boredom <-> effort	*r* = -0.47			
Pekrun et al. (2002)	230	university students	Unspecified		boredom <-> motivation (study interest)	*r* = -0.63	-0.36	-0.47	-0.25
					boredom <-> motivation (effort)	*r* = -0.5			
					boredom <-> strategies (elaboration)	*r* = -0.26			
					boredom <-> strategies (rehearsal)	*r* = -0.06			
					boredom <-> resources (irrelevant thinking)	*r* = -0.72[#]			
					boredom <-> regulation (self-regulated)	*r* = -0.21			
					boredom <-> regulation (external)	*r* = -0.17[#]			
Pekrun et al. (2009)	213	Undergraduates	Learning-related		boredom <-> midterm performance	*r* = -0.13	-0.13	-0.26	0.00
Pekrun et al. (2010)	203	Undergraduates	Learning-related	Study 2	boredom <-> attention problems	*r* = -0.65[#]	-0.31	-0.43	-0.18

					boredom <-> intrinsic motivation	*r* = -0.61			
					boredom <-> effort	*r* = -0.45			
					boredom <-> elaboration	*r* = -0.07			
					boredom <-> rehearsal	*r* = 0.19			
					boredom <-> self-regulation	*r* = -0.26			
	122	undergraduate	Learning-related	Study 3	boredom <-> attention problems	*r* = -0.77[#]	-0.36	-0.51	-0.20
					boredom <-> intrinsic motivation	*r* = -0.43			
					boredom <-> effort	*r* = -0.51			
					boredom <-> elaboration	*r* = -0.26			
					boredom <-> rehearsal	*r* = 0.01			
					boredom <-> self-regulation	*r* = -0.22			
	389	undergraduate	Learning-related	Study 4	boredom <-> intrinsic motivation	*r* = -0.26	-0.26	-0.35	-0.17
					boredom <-> effort	*r* = -0.48			
					boredom <-> elaboration	*r* = -0.26			
					boredom <-> rehearsal	*r* = -0.04			
					boredom <-> self-regulation	*r* = -0.28			
	287	undergraduate	Learning-related	Study 5	boredom <-> final course grade	*r* = -0.36	-0.36	-0.46	-0.25
Pekrun et al. (2011)	389	undergraduate	Class-related		class-boredom <-> self-efficacy	*r* = -0.27	-0.22	-0.31	-0.12
					class-boredom <-> intrinsic motivation	*r* = -0.23			

	class-boredom <-> extrinsic motivation	*r* = 0
	class-boredom <-> effort	*r* = -0.42
	class-boredom <-> elaboration	*r* = -0.19
	class-boredom <-> rehearsal	*r* = -0.04
	class-boredom <-> self-regulation	*r* = -0.16
	class-boredom <-> external regulation	*r* = -0.25[#]
Learning-related	learning-boredom <-> self-efficacy	*r* = -0.34
	learning-boredom <-> intrinsic motivation	*r* = -0.26
	learning-boredom <-> extrinsic motivation	*r* = -0.02
	learning-boredom <-> effort	*r* = -0.48
	learning-boredom <-> elaboration	*r* = -0.26
	learning-boredom <-> rehearsal	*r* = -0.05
	learning-boredom <-> self-regulation	*r* = -0.28

					learning-boredom <-> external regulation	*r* = -0.24[#]			
Pekrun et al. (2014)	424	Undergraduate	Learning-related	Time1	boredom <-> test result	*r* = -0.23	-0.30	-0.39	-0.21
				Time2	boredom <-> test result	*r* = -0.35			
				Time3	boredom <-> test result	*r* = -0.31			
				Time4	boredom <-> test result	*r* = -0.29			
				Time5	boredom <-> test result	*r* = -0.31			
					boredom <-> intrinsic motivation	*r* = -0.32			
Perry et al. (2001)	234	Undergraduate	Course-related		course boredom <-> intrinsic motivation	*r* = -0.63[##]	-0.33	-0.44	-0.21
					course boredom <-> elaboration	*r* = -0.23			
					course boredom <-> self-monitoring	*r* = -0.36			
					course boredom <-> class notes	*r* = -0.33			
					course boredom <-> discussion with classmates	*r* = -0.12			
Stavrova & Urhahne (2010)	96	Grades 8-9	Class-related		boredom <-> knowledge post-test	*r* = -0.08	-0.39	-0.54	-0.20
					boredom <-> intrinsic motivation	*r* = -0.69			
Tze (2011)	254	Undergraduate	Learning-related	Chinese	Boredom <-> SESRL	*r* = -0.43	-0.22	-0.35	-0.11

				sample					
					Boredom <-> intrinsic motivation	*r* = -0.12			
					boredom <-> GPA	*r* = -0.11			
	151	Undergraduate	Learning-related	Canadian sample	Boredom <-> SESRL	*r* = -0.39	-0.18	-0.33	-0.02
					Boredom <-> intrinsic motivation	*r* = -0.19			
					boredom <-> GPA	*r* = 0.04			
Tze & Daniels (2013)	102	Undergraduate	Class-related		boredom frequency <-> achievement	*r* = 0.058	0.06	-0.14	0.25
Tze et al. (2014)	144	Undergraduate	Learning-related	Time 2	learning-related boredom <-> vigor	*r* = -0.64	-0.45	-0.57	-0.31
					learning-related boredom <-> dedication	*r* = -0.65			
					learning-related boredom <-> absorption	*r* = -0.63			
					learning-related boredom <-> effort	*r* = -0.42			
				Time 3	learning-related boredom <-> vigor	*r* = -0.47			
					learning-related boredom <->	*r* = -0.6			

	dedication	
	learning-related boredom <-> absorption	r = -0.44
	learning-related boredom <-> effort	r = -0.37
Time 4	learning-related boredom <-> vigor	r = -0.49
	learning-related boredom <-> dedication	r = -0.55
	learning-related boredom <-> absorption	r = -0.5
	learning-related boredom <-> effort	r = -0.37
Time 5	learning-related boredom <-> vigor	r = -0.45
	learning-related boredom <-> dedication	r = -0.55
	learning-related boredom <-> absorption	r = -0.41
	learning-related boredom <->	r = -0.43

		effort	
Class-related	Time 2	class boredom <-> vigor	*r* = -0.51
		class boredom <-> dedication	*r* = -0.65
		class boredom <-> absorption	*r* = -0.49
		class boredom <-> effort	*r* = -0.34
	Time 3	class boredom <-> vigor	*r* = -0.31
		class boredom <-> dedication	*r* = -0.49
		class boredom <-> absorption	*r* = -0.29
		class boredom <-> effort	*r* = -0.25
	Time 4	class boredom <-> vigor	*r* = -0.41
		class boredom <-> dedication	*r* = -0.5
		class boredom <-> absorption	*r* = -0.41
		class boredom <-> effort	*r* = -0.3
	Time 5	class boredom <-> vigor	*r* = -0.35
		class boredom <-> dedication	*r* = -0.47
		class boredom <-> absorption	*r* = -0.31
		class boredom <-> effort	*r* = -0.29

Note. # represents a reversed sign of original statistics reported for consistency in overall direction among studies in the meta-analysis.

represents a reversed sign of original statistics reported upon written confirmation received from the first author of the study.

Table 2.2. Moderator analysis

Moderator	*k*	$\bar{r}$	CI Lower Limit	CI Upper Limit
Types of academic outcomes				
Motivation	16	-.40	-.48	-.31
Study strategies/behaviours	14	-.35	-.43	-.27
Achievement	21	-.16	-.21	-.11
Age groups				
Secondary	7	-.26	-.38	-.13
Post-secondary	27	-.23	-.28	-.18
Types of academic activities				
In class	8	-.33	-.39	-.27
While studying	14	-.26	-.32	-.21

CHAPTER THREE: PATTERNS OF BOREDOM AND ITS RELATIONSHIP WITH PERCEIVED AUTONOMY SUPPORT AND ENGAGEMENT (Tze, Klassen & Daniels, 2014)

Introduction

Students' learning motivation and emotions have long been a major focus in educational research. Specifically, a negative emotion—boredom—has been shown to be commonly experienced by students in school settings. For instance, Mann and Robinson (2009) have found that almost 60% of university students reported being bored more than half of the time in lectures. In Larson and Richards's study (1991), middle-school students experienced boredom during about 30-40% of class time in most of their subject areas. In addition, researchers have shown that boredom is a negative and deactivating emotion which occurs when students perceive a lack of control over academic activities that are either far beyond or below their capabilities, and/or when they perceive that there is no value in their learning tasks (e.g., Goetz, Pekrun, Hall, & Haag, 2006). Not only can boredom be understood from the control-value theory of emotions (Pekrun, 2006) that will be described in the subsequent section, but it is also conceptually aligned with a lack of flow during an activity (Nakamura & Csikszentmihalyi, 2005) due to "overmatching [or] underutilizing" (p. 90) an individual's ability. Furthermore, boredom is consistent with lack of autonomous regulation because of an inability to identify and internalize the value of an activity (Niemiec & Ryan, 2009). Although students who experience boredom during class or while studying may not be disruptive (Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010), the negative impacts, such as reduced motivation and use of learning strategies, and lower academic attainment, cannot be ignored (e.g., Daniels et al., 2008; Pekrun, Goetz, Titz, & Perry, 2002).

In the literature, researchers have investigated the negative relationships between boredom and various learning outcomes (e.g., self-regulation and achievement) and other academic emotions (e.g., enjoyment) (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). In particular, Pekrun and his colleagues (2010) conducted a series of studies on academic boredom among university students using both cross-sectional and longitudinal designs. The authors found negative correlations between boredom and intrinsic motivation, *r*s= -.26 to -.61, and effort regulation, *rs* = -.45 to -.51. The authors then followed up with another group of university students and found that boredom, assessed at the mid-point of a full-year course, significantly predicted their course performance. Other researchers examined the impact of boredom using a qualitative perspective. Kanevsky and Keighley (2003) interviewed three underachieving gifted high school students. The authors found that being bored in school led to those gifted students being suspended and/or dropping out of school. Although a modest number of studies have examined boredom, most have concentrated on measuring students' levels of boredom during one class or while studying.

Recently, in response to this research gap, Ahmed, van der Werf, Kuyper, and Minnaert (2013) followed a group of Grade 7 students and found that students' levels of trait academic boredom increased over time. In addition, the authors found that the increasing level of boredom was associated with students' reducing use of self-regulated learning strategies and their declining achievement in mathematics. Although Ahmed et al.'s study advanced our understanding of how trait academic boredom changes over a school year, little is known about the developmental trend of state boredom among university students, and the extent to which this commonly experienced emotion relates to antecedents and consequences, specified in Pekrun's (2006) framework of academic emotions. As Vogel-Walcutt, Fiorella, Carper, and Schatz (2012) argue, it is important to examine state boredom because this "can be effectively assessed and mitigated within educational settings" (p. 90). Hence, in this study, we first explore the trajectories of state boredom and engagement for university students over an academic semester. We then examine how changes in boredom relate to changes in engagement. Lastly, we evaluate how perceived autonomy support—an important situational factor for learning (e.g., Tsai, Kunter, Lüdtke, Trautwein, & Ryan, 2008)—is associated with the pattern of change in boredom.

Theoretical Framework and Empirical Evidence of Academic Boredom

As Vogel-Walcutt et al. (2012) note, boredom experienced in academic settings is commonly conceptualized as a negative and deactivating emotion. To investigate this emotion, the present study was therefore based on the control-value theory of emotion developed by Pekrun (2006) which focuses not only on antecedents, emotions, and effects but also on their concurrent relationships over time, and we also discussed how the psychological need of competence specified in self-determination theory (Deci & Ryan, 2012) is consistent with the current understanding of academic boredom. Specifically, in Pekrun's framework, the cognitive appraisal of control and values of academic-related situations and personality factors are considered antecedents to boredom. The control-value theory further depicts how the experience of boredom subsequently affects students' engagement and performance.

Antecedents of Boredom

Cognitive appraisals. In Pekrun's (2006) framework, the cognitive appraisal of learning activities and situations is a proximal factor contributing to academic boredom. Specifically, if students perceive that they lack control over their learning, which they view as being either beyond or above their capability, boredom may be induced. In addition, the attribution of boredom to over-challenged learning is also considered a threat to the basic psychological need of competence in self-determination theory (Niemiec & Ryan, 2009). If students place a low value on learning-related tasks or on academic situations, they may also experience boredom. As Pekrun states, these two dimensions—control and value—have a direct influence on students' academic boredom. This theoretical perceptive has been supported by empirical evidence (e.g., Goetz et al., 2006; Pekrun et al., 2010, 2011). Goetz and his colleagues conducted a correlational analysis regarding middle-school students' cognitive appraisals and boredom experience in the context of Latin instruction. The authors found that boredom was significantly associated with self-reported control, $r = -.25$, and intrinsic value, $r = -.50$. Pekrun and his colleagues found a similar pattern of results among university students in Canada and Germany. Although these findings provide some support to the relationships between boredom and appraisals of low control over and low value of learning, in order to unfold the causal relationship, Pekrun and his colleagues assessed university students' perception of their academic control and value at the beginning of a course and levels of boredom in the middle of the course, thereby accounting for temporal difference. The authors found that the levels of both control and value reported earlier negatively predicted boredom reported later in the course, providing evidence for the influence of control-value appraisals on the experience of boredom.

Learning environment. While low control and value appraisals are proximal factors for the experience of boredom, learning environment can be considered a distal factor that triggers different cognitive appraisals. It is of particular importance to consider this distal factor because it indicates potential avenues to help ameliorate boredom on the teachers' side. Although a multitude of factors, such as the structure and clarity of instruction in a learning environment may influence students' experience of boredom, a lack of support for students' autonomy is expected to influence cognitive appraisals (Pekrun, 2006). In other words, in a learning environment where there are minimal options or choices provided, students may be likely to interpret that they do not have control over their learning. Similarly, if students are taught to focus only on memorization without being provided with learning implications, they may perceive that the learning has low value. The importance of perceived autonomy support was supported by Sierens, Vansteenkiste, Goossens, Soenens, and Dochy's (2009) findings, in which the authors found that without a provision of substantial autonomy support, university students did not engage in high levels of self-regulation even though instruction was structured and expectations were clear. Moreover, Daschmann, Goetz, and Stupnisky (2011) found that aspects of quality instruction, such as providing autonomy and reinforcement, were negatively associated with varying causes of boredom (e.g., being bored due to a lack of meaning and being over-challenged) among grade school students, providing some support to the theoretical claims. Furthermore, in the literature, researchers have found positive impact of autonomy support on students' learning (e.g., Jang, Reeve, & Deci, 2010; Reeve, Jang, Carrell, Jeon, & Barch, 2004). Tsai et al. (2008) examined Grade 7 students' perceived autonomy support and their levels of interests in learning. The authors found that students' perceived autonomy support positively predicted their levels of interests in learning mathematics, German, and a foreign language. Similarly, Kaplan and Assor (2012) found that the more the junior high students perceived having autonomy supportive conversations with their teachers, the lower their experience of negative emotions. These findings, when taken together, indicate the importance to systematically examine how perceived autonomy support is related to students' experience of boredom over a course of study.

Different Types of Academic Boredom

Boredom during study versus in class. In both Mann and Robinson's (2009) and Larson and Richard's (1991) studies, students commonly reported being bored in class. In addition, students also feel bored while studying (e.g., Tze, Klassen, Daniels, Li, & Zhang, 2013). As discussed earlier, being bored while studying and in class could be related in part to the learning environment (for example, teacher-centered lecturing), and/or to cognitive appraisals of situations (such as not finding meaning in studying). Specifically, Pekrun and his colleagues (2011) examined the relationships between the two using a university student sample and found a high correlation, $r = .73$, between boredom experienced in class and while studying. Despite the close relationship, being bored while studying showed a consistent pattern of relatively more negative relationships with academic control, motivation, use of learning strategies, and achievement than being bored in class. Although more empirical studies on both types of boredom have been conducted, most of them only assess this emotion one time, and there is a lack of systematic understanding of how boredom develops and changes while students study and when they are in class. Furthermore, although Ahmed et al. (2013) found an increase in academic boredom among a sample of Grade 7 students over a school year, they combined the two types of boredom into a single construct that limited the identification of how each type of boredom changes over time. Hence, to fill this gap, a multi-wave study with repeated measures on the two types of boredom—learning-related and class-related—is necessary.

Consequences of Being Bored

Given that boredom is a negative and deactivating emotion, being bored within educational contexts is expected to induce task-irrelevant thoughts and lower academic motivation, foster less autonomous types of self-regulation (Niemiec & Ryan, 2009), and limit the students' range of proactive learning strategies (Pekrun et al., 2002; Pekrun, 2006), referred as behavioural, cognitive, motivational, and cognitive-behavioural engagement (Pekrun & Linnenbrink-Garcia, 2012). In particular, behavioural, cognitive, motivational, and cognitive-behavioural engagements are components of a multidimensional construct—student engagement (Pekrun & Linnenbrink-Garcia, 2012). According to Pekrun and Linnenbrink-Garcia, behavioural engagement pertains to the amount of effort put in learning, leading to quantifiable task completion; cognitive engagement refers to automatic cognitive process related to learning (e.g., paying attention in class); motivational engagement refers to task-related motivation and goals (e.g., intrinsic motivation and mastery goal); cognitive-behavioural engagement pertains to intentional task-related cognitive process, such as self-regulation. The authors also point out that emotional engagement—that is emotions experienced in academic activity (Reeve & Tseng, 2011)—influence the above types of engagement. In the present study, we consider emotional engagement as affective engagement in order to capture cognitive-affective dimensions, such as vigor, in addition to the emotional dimension.

In the control-value framework, the negative impact of boredom on learning motivation and strategies predicts achievement. When students have reduced engagement (e.g., less effort put in learning and less motivation to succeed), it is not surprising to witness lower academic performance when they are bored. Empirical findings have provided support for this theoretical prediction regarding the negative effects of being bored (e.g., Artino, La Rochelle, & Durning, 2010; Daniels et al., 2008). Artino and Stephens (2009) found that higher motivational beliefs coupled with lower negative emotions (e.g., boredom) were related with a greater use of metacognitive strategies (cognitive-behavioural engagement). In Pekrun et al.'s (2010) study, boredom was negatively related to behavioural (effort regulation), cognitive (attention), motivational (intrinsic motivation), and cognitive-behavioural (e.g., self-regulation) engagement. Specifically, lower student engagement has been shown to negatively affect academic performance (e.g., Finn & Zimmer, 2012; Reeve & Tseng, 2011). Thus, being bored in schools may have effects that carry over to performance. Daniels and her colleagues used a longitudinal method to examine university students' boredom and their achievement. The authors found that self-reported levels of boredom measured early in the year negatively related to final grade, $r = -.22$, supporting the negative association of boredom with academic attainment. These results provide a solid foundation for further investigation into the correlates of boredom. Given that these studies only measured student engagement at a single time point, our study expands this body of work in academic boredom by examining the changes in multidimensional engagement across time.

As Pekrun (2006) and Pekrun and Linnenbrink-Garcia (2012) note, academic boredom not only can be understood from its antecedents and consequences, but from the reciprocity of these factors. In order to examine these reciprocal relationships, researchers have to first identify the pattern of change in boredom over a period of time, and how the change corresponds to precursors to boredom and to consequences. Thus, an investigation of antecedents, emotions, and effects over time would shed light on our understanding of the pattern of academic boredom, and of its association with students' engagement.

Purpose of This Study

Although past research has shown factors contributing to the experience of boredom and has identified the negative effects of academic boredom on learning and achievement (e.g., Artino & Stephens, 2009; Daniels et al., 2008), most studies have examined the relationships between antecedents, boredom, and consequences in one episode. Therefore, this study is designed to explore the patterns of perceived autonomy support, boredom, and engagement over time, expanding our understanding of the interplay among these factors in students' educational development. In particular, the present study examines changes in two types of academic boredom—learning-related and class-related—at state level, extending Ahmed et al.'s (2013) study that focused on trait academic boredom. Moreover, the inclusion of multidimensional student engagement advances our current understanding regarding the concurrent relationship between engagement and academic boredom. In addition, we expand on Ahmed et al.'s investigation by evaluating the predictive relationship of one aspect of teaching instruction—perceived autonomy support—on the pattern of change in boredom over time. Trait boredom and engagement are not included because the present study focuses on the concurrent changes between boredom and engagement as well as predictive correspondence between perceived autonomy support, which is supposed to be an antecedent, and boredom. Given that perceived autonomy support exerts an impact on emotional experiences (based on both control-value and self-determination theories), it was our goal to examine how perceived autonomy support in general would be related to the change of boredom, in addition to the predictive relationship over time.

Building on the control-value theory of emotion (Pekrun, 2006) and previous studies on academic boredom (e.g., Daniels, et al., 2008; Daschmann et al., 2011), we expected that:

H_1: Boredom (learning-related and class-related) would increase during a course of study.

H_2: Student engagement (vigor, absorption, dedication, and effort regulation) would show a decrease over time.

H_3: At the beginning of a course, a higher level of boredom would be related to a lower level of student engagement, and during a course of study, an increase in the level of boredom would simultaneously relate to a decrease in the level of student engagement.

H_4: Perceived autonomy support and boredom would be inversely related during a course.

Method

Participants and Procedure

A total of 158 students (mean age = 22.97 years, *SD* = 5.95) were recruited through a participant pool at a Canadian university. Of these participants, 118 were females and 40 were males, and 37% majored in elementary education and 63% majored in secondary education. The participants completed five online questionnaires, which were administered in mid-September (1^{st}), early October (2^{nd}), mid-late October (3^{rd}), mid-November (4^{th}), and early December (5^{th}), in exchange for course credits. Although the survey included several questionnaires, only those related to perceived autonomy support, boredom, and engagement constructs were used in these analyses. The only Time 1 measure included in the present study was students' perceived autonomy support from their teachers; this represented a trait dimension of the construct and served as a time-invariant covariant. Times 2 to 5 assessed state perceived autonomy support, boredom, and engagement. Students were asked to indicate how they felt in a given week. Each questionnaire was administered approximately three weeks apart. Fourteen participants' data were excluded because they were late (i.e., after the administration of Time 2 measure) to indicate their willingness to participate in this research study. This resulted in 144 students' responses meeting the interval criterion for the latent growth curve model analysis.

Measures

Perceived autonomy support. A six-item scale from the Learning Climate Questionnaire (LCQ; Williams & Deci, 1996) was used to assess students' perceptions of support for their autonomy in learning in general (Time 1) and such perceptions in a given week (Time 2 to Time 5) during a course. The Time 1 measure began with a common statement (i.e., "Instructors have different styles in dealing with students, and we would like to know more about how you have felt about your encounters at university," followed by perceived autonomy support statements, such as "my instructors encouraged me to ask questions." Time 2 to Time 5 measures began with a common statement emphasizing the state dimension (i.e., "Instructors have different styles in dealing with students, and we would like to know more about how you have felt about your instructor THIS WEEK" and it was followed by perceived autonomy support statements, for example, "I felt that my instructor provided me choices and options". Participants responded on a 7-point scale (1 = *strongly disagree* to 7 = *strongly agree*). The LCQ has shown good reliability and validity in past studies (αs range from .93 to .96; e.g., Black & Deci, 2000; Williams, Saizow, Ross, & Deci, 1997).

Academic boredom. Learning-related and class-related boredom scales from the Academic Emotions Questionnaire (AEQ; Pekrun, Goetz, & Perry, 2005; Pekrun et al., 2002) were used to measure students' level of boredom while studying and in class, respectively. The instructions asked participants to indicate how they felt while studying in a given week (e.g., "The material bored me to death") and in class (e.g., "The lecture bored me") on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*). In previous research, the scales have shown good reliability and validity (αs range from .89 to .93; e.g., Pekrun et al., 2010, 2011).

Engagement. Cognitive, affective, and motivational engagement were measured by the shortened version of the Utrecht Work Engagement Scale for Students (UWES-S) from Salanova, Salanova, González-Romá, and Bakker (2002). The UWES-S consists of 9 items measuring three domains: vigor (e.g., "When I was studying, I felt mentally strong."), absorption (e.g., "Time flew when I was studying"), and dedication (e.g., "I found my studies to be full of meaning and purpose"), corresponding to affective, cognitive, and motivational engagement, respectively. Participants responded on a 7-point scale (1 = *never* to 7 = *always*). Past research has shown that the UWES-S demonstrates adequate reliability and validity (αs range from .70 to .73; e.g., Schaufeli & Bakker, 2003). Behavioural engagement was measured using three items (e.g., "I worked hard to do well in this class even if I didn't like what we were doing") in the effort regulation subscale from the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991). Participants responded using a 7-point scale (1 = *not at all true of me* to 7 = *very true of me*). Previous research has shown that the scale demonstrates adequate reliability and validity (αs range from .62 to .79; e.g., Pekrun et al., 2010; Pintrich, Smith, Garcia, & McKeachie, 1993).

Plan of Analysis

In order to examine changes in boredom and engagement over a semester, latent growth curve modelling (LGCM) was used and data was analyzed in MPlus 7.0 (Muthén, & Muthén, 1998-2012). The LGCM not only identifies a general trajectory (i.e., fixed effect) in a given sample but also examines the variability (i.e., random effect) among individuals (Curran, Obeidat, & Losardo, 2010). In other words, the LGCM examines the extent to which boredom and engagement change over time and whether there is any individual difference in change patterns after accounting for initial levels on these constructs. In addition, Curran et al. note that the

LGCM allows examination of more complex models such as involving a time-varying predictor and evaluating two developmental trajectories simultaneously.

In the LGCM, missing data were handled through maximum likelihood estimation (Muthén, & Muthén, 1998-2012), allowing a relatively more accurate estimation of parameters (e.g., Enders, Dietz, Montague, & Dixon, 2006). Unconditional latent growth curve models for each dependent variable were first examined: two types of boredom and four types of engagement. In the unconditional model, we examined the initial level of and the rate of change in each boredom and engagement variable, as well as the extent to which the initial level and the rate of change were related. In order to systematically evaluate how boredom and engagement change over time, all six testable models (i.e., null model, random intercept, fixed slope, random slope, fixed quadratic, and random quadratic) were conducted and examined. The null model is considered the baseline model which establishes the initial mean with no individual variability. The random intercept model frees this constraint placed on the null model, thereby allowing an estimation of individual differences in the initial mean. Both the fixed slope and random slope models test whether the pattern of change follows a linear trajectory. To specify a linear slope in the models, path loadings from the latent linear slope factor are fixed at 0, 1, 2 and 3. The differences between the two models lie in the former restraining no individual variability in terms of the linear rate of change and the latter relaxing this constraint in the model specification. An additional latent slope factor is included to test quadratic trajectory models, both fixed and random, and paths loadings from the latent quadratic factor are therefore fixed at 0, 1, 4, and 9 to represent a quadratic trend. Similar to the linear slope models, the fixed quadratic model specifies no individual difference in the pattern of change, whereas random quadratic model removes this constrain. Given that the LGCM falls within the structural equation modelling

(SEM) framework (Curran et al., 2010), three common goodness-of-fit indices—χ^2/df, comparative fit index (CFI), and root mean squared error of approximation (RMSEA)—from SEM were used to examine the fit of the LGCM. A χ^2/df ratio of less than 3.0, a CFI index equal to or larger than .90, and an RMSEA index of less than .10 indicate an adequate fit (e.g., Blunch, 2008; Brown, 2006). The best fitting growth model is chosen based on the three goodness-of-fit indices and on guidance from theory, as well as whether growth components (i.e., linear and quadratic slopes) are significant. Models showing an adequate fit and a growth component were retained for subsequent analysis.

Two types of conditional models—parallel processes LGCM, and LGCM with time-invariant and time-varying predictors —were tested. The first type of conditional model was used to examine the parallel changes between boredom and engagement. This conditional LGCM not only tested the concurrent changes between two variables and their initial relationships, but also evaluated whether the initial level of boredom predicted the trajectory of engagement and vice versa. The second type of model involved a time-invariant factor (i.e., a general perception of teachers' autonomy support) and a time-varying predictor (i.e., rating of perceived autonomy support once every three weeks during a course), and they were entered in the LGCM for boredom; this examined how prior experience regarding autonomy support predicted the initial level and rate of change in boredom, and how the time-varying perception of this support predicted students' corresponding levels of boredom.

Results

Descriptive Statistics and Correlations

Table 3.1 shows the descriptive statistics related to and correlations among perceived autonomy support, boredom (learning-related and class-related), and four student engagement (vigor, absorption, dedication, and effort regulation) variables. Most of the variables showed a good degree of internal reliability, except in two instances in which effort regulation demonstrated less than ideal reliability coefficients (i.e., Time 2 $\alpha = .57$ and Time 5 $\alpha = .50$). This might be related to that fact that fewer items, instead of the original four items ($\alpha = .69$), were used due to practical concerns about time demands placed on participants in multi-wave data collection. However, the three-item scale did show acceptable reliability at Time 3 ($\alpha = .68$) and 4 ($\alpha = .66$). In consideration of prior empirical studies showing the reliability of the overall scale and usefulness of items (e.g., Pekrun et al., 2010; Pintrich et al., 1993; Sungur, 2007), the effort regulation variable in the two aforementioned time points was therefore retained for subsequent analyses.

Correlations for each variable across time were significant, and most were of medium magnitude as shown in Table 3.1. In line with relations specified in the control-value theory (Pekrun, 2006), perceived autonomy support at each individual time-point significantly correlated with learning-related and class-related boredom, and with three student engagement measures (i.e., vigor, absorption, and dedication; *r*s range .19 to .43, *p*s $< .05$), and on two occasions (Time 3 and 5) it correlated with effort regulation. These results indicated that the lower the perceived autonomy support reported by students, the higher their levels of boredom, both while studying and in class, and the lower their engagement in learning most of the time. A similar pattern of results was observed between each boredom type and the four student engagement variables (*r*s range -.25 to -.65, *p*s$<.01$), suggesting that the more bored students reported themselves to be, the lower their levels of affective, cognitive, motivational, and behavioural engagement. Taken together, these results are consistent with prior studies examining the relationship among boredom and its antecedents and effects (e.g., Pekrun et al., 2010; Tze, Daniels, Klassen, & Li, 2013).

Unconditional Latent Growth Curve Models

Table 3.2 shows the goodness of fit indices and the parameters for a best fitting unconditional latent growth curve model for each type of boredom and student engagement. It also includes the competing models tested. The trajectory of students' boredom experienced and their engagement was examined in unconditional LGCM. In other words, the pattern of change in the above variables was estimated individually.

Trajectory of the two types of boredom. Although both fixed slope and random slope models of the class-related boredom showed good model fit, the least restrained—random slope—model was chosen. This was because the random slope model not only showed the same pattern of results found in the fixed slope model but also allowed subsequent analysis of the parallel processes LGCM, which requires individual variability to be estimated. Based on results of the random slope model, class-related boredom showed a linear growth trajectory (Figure 3.1) with good model fit, χ^2 (5) = 11.772, p =.038, χ^2/df = 2.354 CFI = .967, RMSEA = .097. Both the mean intercept (b_0 = 27.948) and slope (b_1 = .713) were significant (p < .01 and p = .032, respectively), indicating that the initial level of class-related boredom was significant and the rate of change followed a linear trajectory: an increase in the level of class-related boredom over time. The mean intercept and slope, however, were not significantly correlated, indicating that the initial level of class-related boredom was not associated with the linear increase in the level of class-related boredom experienced. Although the variance of the intercept was significant, that of the slope was not; this suggests that while there were significant individual differences in the initial levels of class-related boredom, there was no statistical difference in the change in students' levels of boredom.

By contrast, the best fitting model for learning-related boredom was a random intercept model, χ^2 (8) = 11.401, p = .180, χ^2/df = 1.245, CFI = .981, RMSEA = .054, because none of the interpretable growth models—fixed slope or random quadratic—showed significant latent linear or quadratic means. In other words, a reliable pattern of change could not be observed in these growth models, which was consistent with the random intercept model. This result thus indicated that overall learning-related boredom was relatively stable during the course.

Pattern of different student engagement components. Similar to results of the learning-related boredom LGCM, vigor and absorption were better represented by a random intercept model, χ^2 (8) = 27.580, p < .01, χ^2/df = 3.448, CFI = .933, RMSEA = .130 and χ^2 (8) = 4.041, p =.853, χ^2/df = .505, CFI = 1.000, RMSEA = .000, respectively. These results indicated that the levels of both vigor and absorption did not increase or decrease during the course, suggesting a relatively stable level of affective and cognitive engagement.

By contrast, the quadratic trajectory of dedication (Figure 3.2), with linear slope variance fixed to zero (i.e., no individual difference in the linear change of dedication), provided the best fitting model, χ^2 (4) = 4.170, p = .384, χ^2/df = 1.043, CFI = .999, RMSEA = .017. The mean intercept (b_0 = 13.341), linear slope (b_1 = -.952), and quadratic term (b_2 = .304) were all significant, ps< .01. This indicated a significant initial level of dedication. Students reported an immediate decrease in dedication to learning; the trend then leveled and was followed by an increase in dedication. In other words, the trajectory of dedication followed a U-shape in our sample. However, the intercept mean and quadratic mean were not significantly correlated, suggesting that the initial level of dedication was not related to the pattern of change in this domain over time. No significant difference in the quadratic variance was found, despite significant variability among students' reports of their initial level of dedication (σ_0^2 = 11.156, *p* < .01).

With regard to effort regulation, although the goodness-of-fit indices of the fixed slope model appeared slightly better than the random slope model, results of both chi-square tests were non-significant, suggesting that the models are comparable. In addition, the random slope model was least restrictive and allowed an estimation of individual differences in the pattern of linear change. Thus, the random slope model was chosen, χ^2 (5) = 8.296, *p* =.141, χ^2/df = 1.659, CFI = .982, RMSEA = .068, and the mean intercept (b_0 = 15.593) and slope (b_1 = -.351) were significant, *p*s<.01. Results indicated that the pattern of effort regulation showed a linear growth pattern, similar to the trajectory of class-related boredom. In other words, students' initial levels of effort regulation were significant, and that their levels of effort regulation linearly decreased over time. The two means, however, were not significantly correlated; this indicated that initial level of effort regulation was not associated with changes in this variable throughout the course. The intercept variance (σ_0^2 = 6.247) was significant, *p* <.001, indicating that students differed on their initial levels of effort regulation; however, the non-significant slope variances (σ_1^2 = .133) suggested that in our sample students generally showed the same pattern of reduced effort regulation.

The results of a random intercept model for learning-related boredom, vigor, and absorption indicated that these variables did not change over time. Therefore, the subsequent analyses did not focus on these variables and instead included class-related boredom, dedication, and effort regulation, all of which showed a pattern of change.

Parallel Processes Model: Class-Related Boredom and Student Engagement

To examine the concurrent relationship and change pattern between class-related boredom and student engagement, the unconditional LGCM for class-related boredom and each significant student engagement growth model (i.e., dedication and effort regulation) were analyzed using the parallel processes model. In light of the significant correlation, $r = -.65$, $p < .001$, between class-related boredom and dedication at Time 2, this relationship was included in the model. The parallel processes model between class-related boredom and dedication showed an excellent model fit, $\chi^2(22) = 26.342$, $p = .237$, $\chi^2/df = 1.197$, CFI =.992, RMSEA = .037. Although the initial intercept of class-related boredom did not predict the trajectory of dedication and vice-versa, both intercepts were significantly correlated, indicating that the higher the students' initial level of boredom, the lower their level of dedication to learning. In addition, the linear slope of class-related boredom was significantly correlated with the quadratic slope of dedication, $\phi = -.27$, $p = .045$. This suggested that an increase in the level of boredom was associated with a decrease in our participants' dedication to learning, particularly from the beginning to the middle of the course.

Similarly, the parallel model between class-related boredom and effort regulation showed a good model fit, χ^2 (24) = 40.718, $p = .018$, $\chi^2/df = 1.697$, CFI =.960, RMSEA = .070, as is shown in Figure 3.3. Although the initial intercept of class-related boredom did not significantly predict the rate of change in effort regulation and vice versa, both initial intercepts were significantly correlated, $\phi = -10.74$, $p < .001$. This suggested that students who reported more initial class-related boredom also indicated putting less regulatory effort into learning at the beginning of the course. As expected, the linear slope of class-related boredom and effort regulation was significantly correlated, $\phi = -.73$, $p = .042$. The results thus indicated that students' experiences of greater class-related boredom over time were associated with less regulatory effort during the course.

Conditional Model: Effects of Perceived Autonomy Support on Class-Related Boredom

General perception regarding instructors' level of autonomy support (time-invariant predictor: trait) and perception of such support over time (time-varying predictors: state) were used to predict the class-related boredom LGCM (Figure 3.4). Specifically, the prediction of the trait general perception of autonomy support on the mean intercept and slope of the LGCM was examined. In addition, the model tested how state perceived autonomy support was correlated with class-related boredom reported at corresponding time phases. This conditional model showed an excellent model fit, χ^2 (19) = 23.958, p =.239, χ^2/df = 1.208, CFI =.982, RMSEA = .041. The prediction (b_1 = -.40) from general perception on the initial level of class-related boredom was significant, p = .01. This result indicated that the higher the level of autonomy support in general that the students felt they received from their instructors, the lower their initial levels of class-related boredom. However, this time-invariant predictor did not significantly predict the rate of change of class-related boredom, suggesting that a general perception of how instructors support students' autonomous learning does not correlate with the pattern of class-related boredom during a course. Consistent with control-value theory, the time varying predictors all significantly predicted class-related boredom at corresponding time-points. This means that the more students perceived being supported as an autonomous learner at a given time, the lower the level of class-related boredom experienced throughout the course.

To complement the conditional model between perceived autonomy support and class-related boredom, the above conditional LGCM (with time-invariant trait perceived autonomy support and time-varying state perceived autonomy support) was conducted on two types of student engagement—dedication and effort regulation—both of which showed a pattern of change over time. Perceived autonomy support and dedication did not emerge as an acceptable model because of negative variances, and despite a good model fit between perceived autonomy support and effort regulation (χ^2/df = 1.636, RMSEA = .072, CFI = .936), only one parameter (i.e., prediction from state autonomy support on effort regulation in Time 5) was significant. Thus, results from the LGCM suggested that perceived autonomy support did not predict change in the two types of student engagement, despite positive correlations. These results may be in part related to a conceptual asymmetry between the two constructs. Perceived autonomy support was conceptualized as a class-related experience, whereas dedication and effort regulation were both measured as a learning-related experience.

Discussion

Not only has boredom been shown to be a common emotional experience in academic-related settings and circumstances (e.g., Mann & Robinson, 2009), but it is also negatively related to a range of students' adaptive factors, such as motivation, use of appropriate learning strategies, and achievement (e.g., Daniels et al., 2008; Pekrun et al., 2010; Tze et al., 2013). Although some researchers have employed longitudinal design to study academic boredom, aiming to unfold the influence of boredom on students' learning, students' level of boredom is often measured in a single episode; researchers are therefore unable to determine how boredom develops and changes over time. As far as we know, there have been only three studies (Ahmed et al., 2013; Goetz, Preckel, Pekrun, & Hall, 2007; Pekrun, Hall, Goetz, & Perry, 2014) examining the change of this negative emotion over an academic year of learning mathematics, during a mathematics test, and while studying for a psychology course, respectively. Therefore, the purpose of this study was to fill gap in our understanding of the trajectory of academic boredom during a course and its concurrent relationship with antecedents and consequences at the post-secondary level. The novel contributions of the present study are threefold. First, this study explores the trajectory of academic boredom, both learning-related and class-related, and the patterns of four dimensions of student engagement among university students over a course of study. Second, this study analyzes the pattern of changes in class-related boredom in relation to those in students' dedication to learning and in their effort regulation. Third, this study identifies the prediction of a distal situational antecedent—perceived autonomy support—on students' class-related boredom over time.

Different Trajectory of Boredom and Student Engagement

Although both class-related and learning-related boredom have received increasing attention in the literature (e.g., Artino, 2009; Lichtenfeld, Pekrun, Stupnisky, Reiss, & Murayama, 2012; Tze et al., 2013), they are usually measured only once in a given empirical study. Therefore, we aimed to examine the patterns of change in these two types of academic boredom in authentic learning contexts and over a substantial period of time (i.e., one semester). When deciding which model fit each type of academic boredom the best, the goodness-of-fit indices were in favor of slightly different models (i.e., class-related boredom: fixed instead of random slope; learning-related boredom: random intercept instead of random quadratic model). In spite of this, a similar pattern of change was observed in each of the competing LGCM results, allowing for the selection of a better fitting and more interpretable model to be made.

Our findings showed that the two types of boredom have different patterns of change. For the class-related boredom, students reported an overall increase in their experiences of this negative emotion, despite the fact that their initial class-related boredom did not associate with this increase over time. Specifically, this overall increase in boredom in classes/lectures did not significantly vary among students. It is reasonable to speculate that these findings may be related in part to the learning context (e.g., didactic lecturing) at the post-secondary level, in which class-related boredom is incubated over time. This pattern of change in class-related boredom is also consistent with Ahmed et al. (2013) finding of a linear increase of trait academic boredom among Grade 7 students. By contrast, our findings showed that the level of learning-related boredom was stable over time, in spite of individual differences at the beginning of the course. Taken together, these results may indicate that although university students felt increasingly bored in class, they did not experience this increase when they studied.

In addition to examining the trajectory of academic boredom, we also tested the pattern of change in the four types of student engagement: affective (vigor), cognitive (absorption), motivational (dedication), and behavioural (effort regulation) using a sample of university students. Again, when selecting which pattern of change fit the data better for each type of student engagement, the model fit indices were in favor of different models. Despite slight differences among fit indices, results of each competing model indicated a similar trajectory for each type of student engagement. Our findings indicate that vigor and absorption remain relatively stable over the course of a semester (i.e., scores were approximately within the corresponding scales' means), suggesting that, in general, these students are affectively and cognitively engaged in learning. By contrast, both dedication and effort regulation to learning change over time. The former followed a U-shape, and the latter followed a linear decline pattern. Regarding motivational engagement in our sample, after the initial reduction, students' level of dedication remained stable in the middle of the course and it increased as the end of the course approached. The fact that these students' dedication to learning follows the same pattern of decline near the beginning of the course may reflect their reduced motivation. However, the level of dedication is relatively stable and subsequently increases to the initial level. This pattern is also consistent with common beliefs about university students' relatively higher motivation to learn; despite possible challenges these students faced throughout the course of their study, they remain dedicated to learning to the end of their course. In terms of behavioural engagement, there is an overall decline in their effort to regulate learning and study as the course progressed. One explanation is that as students became accustomed to the course schedule, demands, assignments, instructor, and expectations, they were able to complete the ongoing work, even if coursework usually becomes more demanding and complicated throughout the semester, with less effortful regulation (e.g., Krohn & O'Connor, 2005). Another possibility is that effort regulation at the start of the year is actually higher than baseline regulation may be. In other words, the process of becoming accustomed to a new course, instructor, and demands may represent heightened effort regulation that then decreases to what is required to manage the workload associated with most university courses (e.g., Ciani, Sheldon, Hilpert, & Easter, 2011; Krohn & O'Connor, 2005). These are both speculative notions and future research is needed to tease apart a thorough explanation.

Parallel Trajectories Between Class-Related Boredom and Engagement (Dedication and Effort Regulation)

Although previous studies (e.g., Pekrun et al., 2011) have shown the interrelationship between class-related boredom and a number of learning factors, such as self-regulation, it is still important to evaluate how the pattern of change in these variables relates to one another, in order to advance our understanding of the concurrent nature between emotion and learning. Our findings indicate that the initial level of class-related boredom is negatively related to both dedication to learning and effort regulation. This result not only highlights the fact that the two distinct constructs are related, but is also consistent with the control-value theoretical framework (Pekrun, 2006) in terms of the dynamic nature between class-related boredom and student engagement. Furthermore, the change in the level of boredom experienced in class over a course of study was related to dedication; in addition, there was significant association between the initial means of these variables. However, in light of the quadratic trajectory in dedication, the significant association of the changes between the two may be more related the early linear increase in class-related boredom and the decrease in dedication during the course. Likewise, the pattern of change in class-related boredom and that in effort regulation both follow a linear trajectory and are related. This relationship indicates that an increase in students' level of boredom in class is associated with a lower level of effort regulation over a course of study. Given the dynamic relationships between an academic emotion and its outcomes in control-value theory, it is thus reasonable to observe this concurrent pattern of change (in the opposite direction) in class-related boredom and effort regulation. These findings together advance our understanding of boredom experienced in class, in particular regarding the dynamic changing pattern in students' motivational and behavioural engagement.

Prediction of Perceived Autonomy Support on Class-Related Boredom

Our findings also reveal an important predictor of class-related boredom. Although the theoretical influence of perceived autonomy support has been discussed in Pekrun's (2006) control-value theory, most studies on academic boredom primarily focus on proximal antecedents (i.e., perceived control and value), and are thus unable to determine the predictive relationship of distal situations on students' experiences with this negative emotion. Our results indicate not only that students' general perceptions about the support provided by their university instructors for autonomous learning negatively predicted the initial level of boredom in class, but also that the perceived autonomy support reported at Time 2 to 5 negatively predicted the corresponding class-related boredom. The results thus indicate the importance of enhancing the provision of autonomy support to students in order to alleviate this negative affective experience, which has been shown to have an adverse impact on learning and achievement (e.g., Daniels et al., 2009; Pekrun et al., 2010). In addition, autonomy support has been shown to be negatively related to a range of situational precursors to boredom (e.g., lack of involvement and monotony) and the tendency to feel bored (Daschmann, Goetz, & Stupnisky, 2011).

Limitations and Future Research

The study has some limitations that are worth noting and some aspects that call for future investigation. One of our measures (effort regulation) did not show good internal consistency on two occasions, which may be related in part to the use of three items instead of the full subscale. Although the items were selected from an established scale, the usefulness of which has been supported empirically, researchers should consider using the full subscale in lieu of selected items. In addition, despite the fact that we had four data points, allowing estimation of both linear and quadratic trajectories, the interaction among perceived autonomy support, boredom experience, and student engagement may occur in shorter durations, such as minutes and days. Thus, it is important to capture the moment-by-moment changes, advancing our understanding of changes in a given moment. Moreover, although multi-wave data are sufficient to test our research hypotheses, our study is limited by the use of students' self-reports which may affect the study's reliability and validity due to common method variance (Drost, 2011) and response sets (Cronbach, 1946). Future research should consider incorporating other informants' reports (e.g., those of instructors) and employing behavioural indicators (e.g., facial expression and gaze-tracking) to further our understanding of the interaction among situational factors, affective experiences (including academic boredom), and learning patterns and outcomes over time. Furthermore, the use of a relatively small convenience sample limits the examination of more complex mediation latent growth curve models (e.g., whether boredom mediates a relationship between perceived autonomy support and engagement). It is important for future researchers to recruit a larger and representative sample not only to evaluate potential indirect relationships among perceived autonomy support, boredom, and engagement, but also to replicate the findings of the present study. Finally, despite the use of longitudinal design and latent growth curve analysis, our findings did not assume causation among perceived autonomy support, boredom, and student engagement. Researchers should consider conducting experimental studies to evaluate the theoretical impact of perceived autonomy support on students' experience of boredom and subsequently on their engagement in the future.

Practical Implications

In spite of the above limitations, our findings highlight the different patterns of change in the two types of academic boredom—learning-related and class-related—which suggest implications for both students and educators. Given that university students' boredom during study is relatively stable over their course of study, students might be encouraged to take concrete steps to actively cope with boredom, such as by identifying the root causes of boredom (Dashmann et al., 2011; Tze, Daniels, & Klassen, 2014), and subsequently targeting the causes using appropriate strategies. For instance, when a university student feels bored while studying for statistics at home, he/she should look at reasons (e.g., *I do not believe that studying statistics helps my future career*) that give rise to this negative affective experience. The student should then employ relevant and adaptive coping strategies specified to the causes of boredom identified. As previous studies have shown the effectiveness of employing cognitive reappraisal strategies to combat boredom (Nett, Goetz, & Daniels, 2010; Tze et al., 2013), the student should look for positive aspects of being in a "boring" situation, such as considering this as an opportunity to learn a new set of skills. It is thus important for university students to develop these adaptive coping skills, and to employ these strategies to cope with this negative emotion when they study.

Students play a key role in managing their learning-related boredom, which is shown to be relatively stable, and educators should take the lead in recognizing their own role in helping students reduce their class-related boredom. As Pekrun (2006) notes, learning contexts can influence students' experience of boredom, and our finding shows that there is a steady increase in class-related boredom provides some support to this statement. Importantly, our findings regarding the prediction of students' perceived autonomy support on their experience of class-related boredom highlight potential avenues for intervening in mitigating the increasing level of boredom. For example, teachers may provide students with choices in completing their assignments and encourage students' questions in class, thereby granting student' autonomy in learning. Consistent with self-determination theory (Deci & Ryan, 2012), educators should also provide an autonomy-supportive learning environment in which teachers emphasize the learning process instead of the evaluation, encourage students' participation into classroom learning experience, and identify the usefulness of learning course materials (Niemiec & Ryan, 2009). To complement educators' efforts, students should look for value in class learning, such as acquiring core knowledge in child development that is applicable to their future teaching, which can help them to better cope with this adverse emotion.

In addition, the parallel changes between class-related boredom and effort regulation, and between class-related boredom and dedication to learning, suggest the importance of addressing this negative emotion. Given that putting appropriate effort into regulating one's study is important to learning and achievement (e.g., Komarraju & Nadler, 2013), it is crucial to intervene in the increase of class-related boredom and simultaneously encourage students to put consistent effort into studying. The intervention can be facilitated by first recognizing the pattern of increased boredom, and second by thorough planning of the course instruction and assignments, such that students are provided not only with appropriate autonomy support in learning but also with a clear indication of the practicality and/or values in attending weekly lectures and completing corresponding coursework. Along the same lines, students may also be better at identifying the purposes of their study in the middle of the course when teachers carefully design the topics that they will cover over times, and when teachers get students involved in learning activities and assessment tasks.

Overall, the present study provides the first attempt to examine the pattern of change in academic boredom and student engagement over an academic semester, as well as the relationship of perceived autonomy support on academic boredom. Our results thus advance the current understanding of the trajectory of the above factors and their concurrent change relationship in the literature. These trajectories allow us to offer new ways to help ameliorate academic boredom and address the associated negative consequences based on this new understanding.

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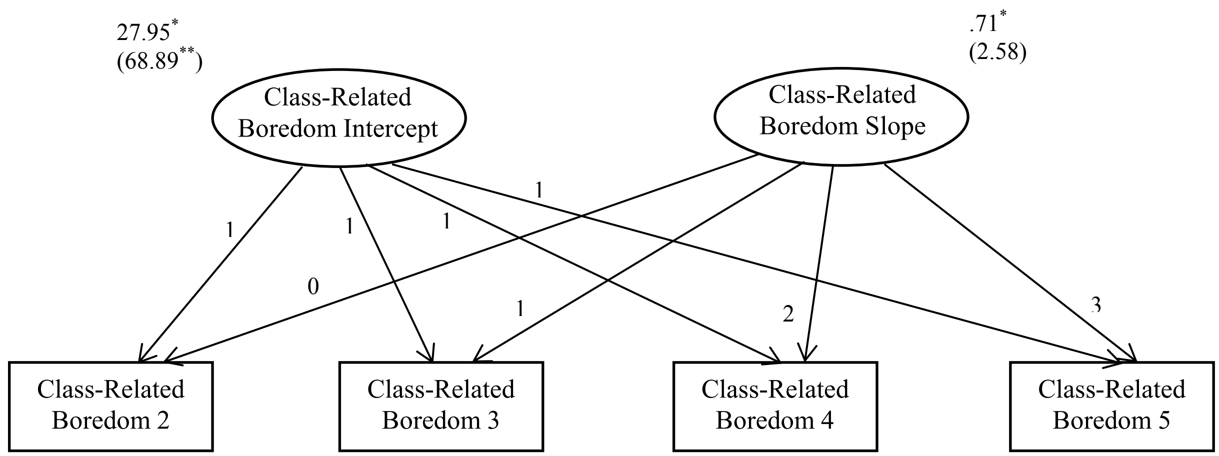
Figure 3.1. Latent growth curve model for class-related boredom

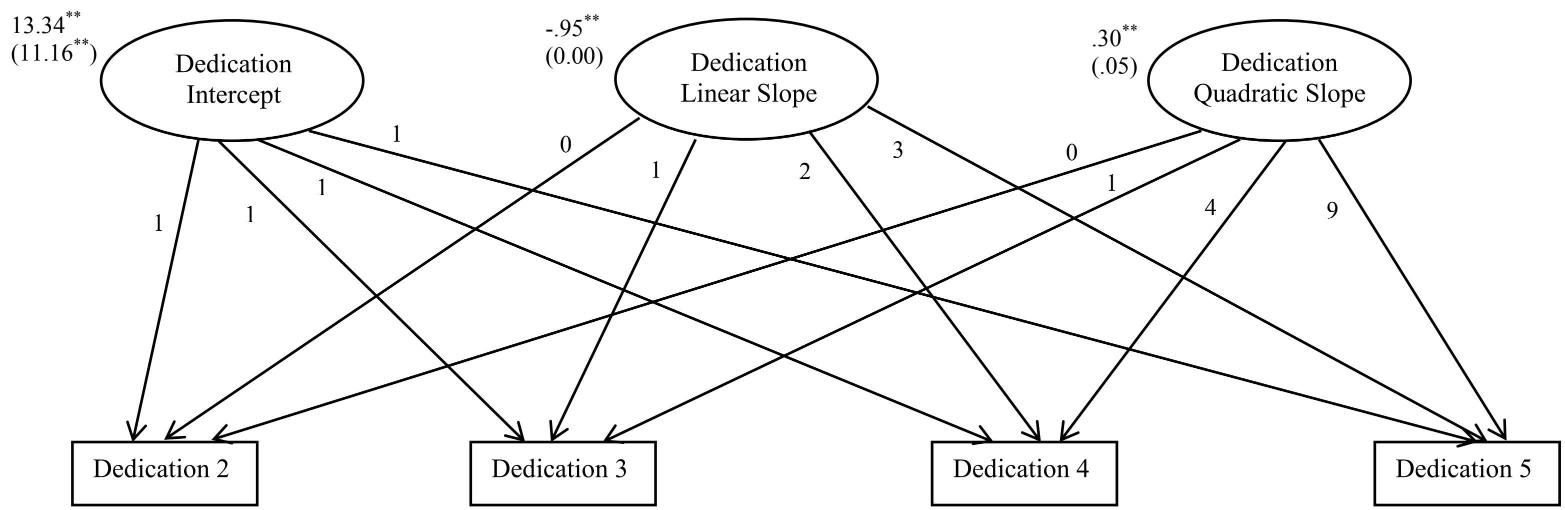


Note. Values on the top row represent the latent mean scores, and those in parentheses represent latent variances.

* $p < .05$

** $p < .01$

Figure 3.2. Latent growth model for dedication

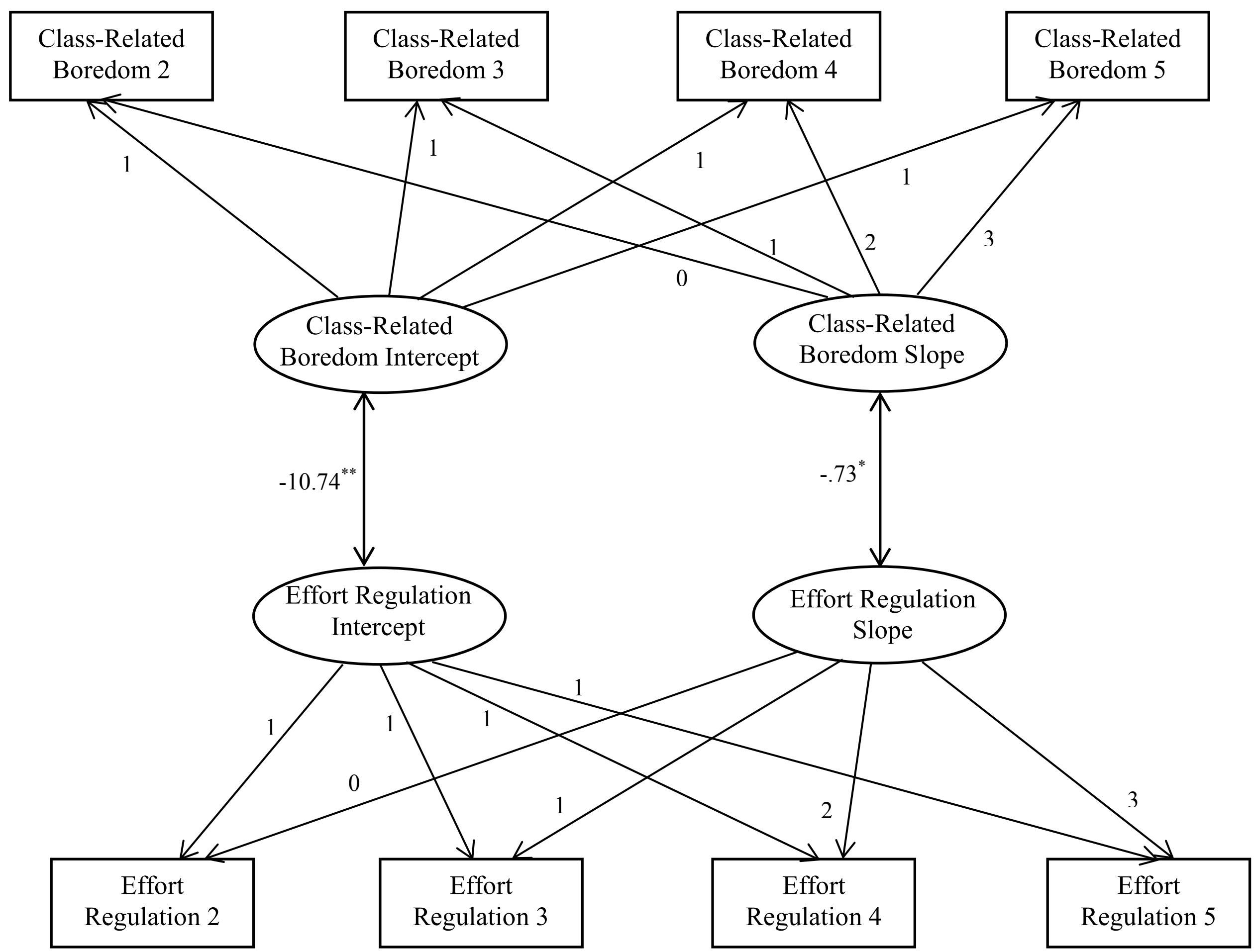


Note. Values on the top row represent the latent mean scores, and those in parentheses represent latent variances.

* $p < .05$

** $p < .01$

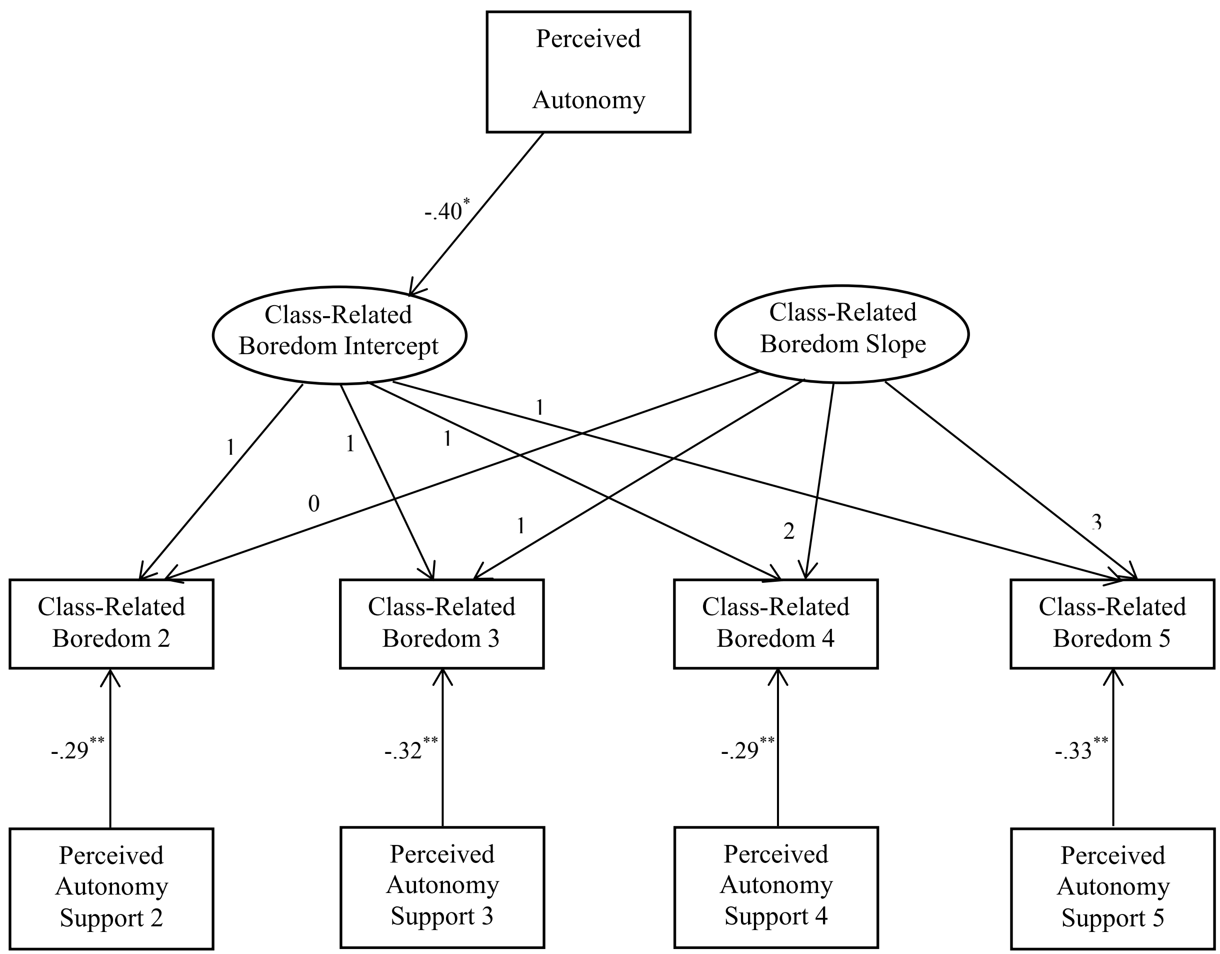
Figure 3.3. Parallel processes model for class-related boredom and effort regulation



* $p < .05$

** $p < .01$

Figure 3.4. The LGCM for class-related boredom with both time-invariant and time-varying predictors of perceived autonomy support



* *p* < .05

** *p* < .01

Table 3.1. Descriptive statistics and correlation among perceived autonomy support, boredom, and engagement

		α	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	PAS_1	.84	26.59 (5.92)	1												
2.	PAS_2	.91	27.92 (7.56)	$.57^{**}$	1											
3.	PAS_3	.95	29.89 (8.64)	$.39^{**}$	$.59^{**}$	1										
4.	PAS_4	.97	26.81 (9.59)	$.37^{**}$	$.48^{**}$	$.55^{**}$	1									
5.	PAS_5	.97	28.58 (9.53)	$.36^{**}$	$.58^{**}$	$.67^{**}$	$.63^{**}$	1								
6.	LRB_2	.94	30.87 (9.69)	$-.24^{**}$	$-.27^{**}$	$-.25^{**}$	$-.21^{*}$	$-.19^{*}$	1							

		α	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
7.	LRB_3	.96	29.92 (10.23)	-.23**	-.22**	-.32**	-.22*	-.28**	.49**	1						
8.	LRB_4	.95	30.60 (9.99)	-.33**	-.21*	-.25**	-.31**	-.27**	.46**	.60**	1					
9.	LRB_5	.96	30.73 (10.67)	-.20*	-.17	-.24**	-.33**	-.27**	.57**	.51**	.56**	1				
10.	CRB_2	.95	28.51 (10.77)	-.32**	-.35**	-.32**	-.24**	-.23**	.72**	.59**	.52**	.42**	1			
11.	CRB_3	.96	27.83 (11.13)	-.28**	-.38**	-.44**	-.32**	-.44**	.43**	.61**	.48**	.49**	.58**	1		
12.	CRB_4	.97	30.71 (12.04)	-.31**	-.22*	-.33**	-.39**	-.33**	.50**	.49**	.71**	.58**	.56**	.64**	1	
13.	CRB_5	.97	29.29 (12.38)	-.23**	-.30**	-.32**	-.33**	-.40**	.51**	.43**	.46**	.74**	.44**	.62**	.56**	1

		α	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
14.	VG_2	.83	11.94 (3.86)	.32**	.31**	.23**	.26**	.13	-.64**	-.33**	-.39**	-.37**	-.51**	-.35**	-.32**	-.35**
15.	VG_3	.80	11.63 (3.52)	.29**	.17*	.21*	.26**	.15	-.55**	-.47**	-.51**	-.47**	-.43**	-.31**	-.43**	-.31**
16.	VG_4	.85	11.79 (3.89)	.32**	.19*	.25**	.39**	.33**	-.36**	-.42**	-.49**	-.48**	-.27**	-.28**	-.41**	-.32**
17.	VG_5	.88	11.61 (3.90)	.38**	.20*	.27**	.28**	.31**	-.41**	-.42**	-.35**	-.45**	-.28**	-.32**	-.27**	-.35**
18.	DD_2	.92	13.41 (4.28)	.33**	.29**	.27**	.20*	.13	-.65**	-.37**	-.44**	-.36**	-.65**	-.40**	-.39**	-.38**
19.	DD_3	.92	12.57 (3.92)	.41**	.28**	.36**	.28**	.24**	-.52**	-.60**	-.55**	-.48**	-.48**	-.49**	-.50**	-.40**
20.	DD_4	.94	12.82 (4.47)	.34**	.24**	.26**	.41**	.33**	-.43**	-.46**	-.55**	-.47**	-.40**	-.42**	-.50**	-.40**

		α	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
21.	DD_5	.92	13.20 (4.17)	.39**	.28**	.39**	.43**	.43**	-.44**	-.42**	-.45**	-.55**	-.33**	-.40**	-.41**	-.47**
22.	AB_2	.89	10.35 (4.58)	.37**	.35**	.14	.25**	.13	-.63**	-.34**	-.43**	-.38**	-.49**	-.38**	-.38**	-.40**
23.	AB_3	.84	10.53 (4.32)	.25**	.21*	.20*	.18*	.16	-.44**	-.44**	-.42**	-.41**	-.37**	-.29**	-.40**	-.27**
24.	AB_4	.89	10.39 (4.59)	.37**	.22*	.07	.19*	.15	-.34**	-.35**	-.50**	-.39**	-.25**	-.27**	-.41**	-.25**
25.	AB_5	.92	10.53 (4.61)	.28**	.17	.13	.24**	.20*	-.33**	-.33**	-.37**	-.41**	-.16	-.18*	-.27**	-.31**
26.	ER_2	.57	15.60 (3.13)	.09	.02	.10	.06	.04	-.42**	-.33**	-.36**	-.31**	-.34**	-.22*	-.30**	-.22*
27.	ER_3	.68	15.25 (3.72)	.26**	.25**	.24**	.12	.19*	-.34**	-.37**	-.28**	-.25**	-.33**	-.25**	-.27**	-.19*

		α	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13
28.	ER_4	.66	14.90 (3.60)	.16	.06	.09	.10	.06	-.34**	-.21*	-.37**	-.28**	-.30**	-.09	-.30**	-.13
29.	ER5	.50	14.68 (3.57)	.20*	.00	.14	.22*	.22*	-.29**	-.26**	-.38**	-.43**	-.19*	-.18*	-.31**	-.29**

		14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
14.	VG_2	1															
15.	VG_3	.68**	1														
16.	VG_4	.49**	.70**	1													
17.	VG_5	.58**	.65**	.74**	1												
18.	DD_2	.66**	.56**	.44**	.41**	1											
19.	DD_3	.49**	.69**	.57**	.50**	.62**	1										
20.	DD_4	.42**	.61**	.76**	.56**	.61**	.69**	1									
21.	DD_5	.50**	.58**	.66**	.76**	.49**	.61**	.63**	1								
22.	AB_2	.76**	.59**	.50**	.58**	.62**	.42**	.47**	.49**	1							
23.	AB_3	.52**	.64**	.58**	.52**	.43**	.64**	.51**	.52**	.58**	1						
24.	AB_4	.45**	.60**	.73**	.60**	.41**	.48**	.63**	.51**	.62**	.66**	1					
25.	AB_5	.46**	.54**	.62**	.74**	.30**	.42**	.43**	.70**	.59**	.63**	.71**	1				
26.	ER_2	.37**	.37**	.27**	.33**	.40**	.31**	.34**	.35**	.37**	.31**	.31**	.30**	1			
27.	ER_3	.23**	.36**	.21*	.30**	.28**	.43**	.29**	.33**	.16	.34**	.18*	.21*	.53**	1		
28.	ER_4	.20*	.30**	.31**	.15	.31**	.26**	.43**	.17	.20*	.23**	.32**	.10	.63**	.54**	1	

29.	ER_5	.19*	.38**	.42**	.34**	.21*	.37**	.41**	.46**	.21*	.29**	.33**	.34**	.45**	.54**	.50**	1

Note. PAS = perceived autonomy support, LRB = learning-related boredom, CRB = class-related boredom, VG = vigor, DD = dedication, AB = absorption, ER = effort regulation. The subscript numbers indicate the time wave of data collection.

* p <.05

** p < .01

Table 3.2. Latent growth models

						Mean			Variance		
	χ^2	*df*	*p*	RMSEA	CFI	Intercept	Slope	Quadratic	Intercept	Slope	Quadratic
<u>Class-related boredom</u>											
Null model	213.501	9	0.000	0.397	0.000	28.976**					
Random intercept	20.279	8	0.009	0.103	0.939	28.882**			75.391**		
Fixed slope	14.721	7	0.040	0.088	0.962	27.890**	0.747*		76.160**		
Random slope	**11.772**	**5**	**0.038**	**0.097**	**0.967**	**27.948****	**0.713*** **(0.078)**		**68.890****	**2.582**	
fixed quadratic	11.767	4	0.019	0.116	0.962	27.926**	0.779 (0.078)	-0.022 {---}	68.882**	2.585	
Random quadratic[#]	7.618	1	0.006	0.214	0.967	27.920**	0.833 (N/A)	-0.002 {N/A} [N/A]	57.667	-19.552	-4.461

	χ^2	*df*	*p*	RMSEA	CFI	Mean			Variance		
						Intercept	Slope	Quadratic	Intercept	Slope	Quadratic
<u>Learning-related boredom</u>											
Null model	187.314	9	0.000	0.371	0.013	30.535**					
Random intercept	**11.401**	**8**	**0.180**	**0.054**	**0.981**	**30.598****			**53.898****		
Fixed slope	11.227	7	0.129	0.065	0.977	30.433**	0.113		53.970**		
Random slope#	7.956	5	0.159	0.064	0.984	30.386**	0.147 (N/A)		39.437**	-1.213	
Fixed quadratic#	6.633	4	0.157	0.068	0.985	30.748**	-0.889 (N/A)	0.348 {---}	39.853**	-1.138	
Random quadratic	0.915	1	0.339	0.000	1.000	30.803**	-0.885 (-0.480)	0.337 {0.480} [-0.984*]	70.459**	63.918*	5.511*

						Mean			Variance		
	χ^2	*df*	*p*	RMSEA	CFI	Intercept	Slope	Quadratic	Intercept	Slope	Quadratic
<u>Vigor</u>											
Null model	299.438	9	0.000	0.473	0.008	11.739**					
Random intercept	**27.580**	**8**	**0.001**	**0.130**	**0.933**	**11.713****			**8.944****		
Fixed slope	26.853	7	0.0004	0.140	0.932	11.830**	-0.080		8.943**		
Random slope	15.187	5	0.010	0.119	0.965	11.848**	-0.088 (-0.215)		9.281**	0.638**	
fixed quadratic	15.101	4	0.005	0.139	0.962	11.882**	-0.170 (-0.216)	0.026 {---}	9.291**	0.638**	
Random quadratic#	1.912	1	0.167	0.080	0.997	11.935**	-0.212 (-0.570*)	0.031 {0.469*} [-0.929**]	14.29**	10.05**	0.822**

	χ^2	*df*	*p*	RMSEA	CFI	Mean			Variance		
						Intercept	Slope	Quadratic	Intercept	Slope	Quadratic
Dedication											
Null model	253.496	9	0.000	0.434	0.000	12.987**					
Random intercept	13.846	8	0.086	0.071	0.976	12.924**			10.627**		
Fixed slope	13.818	7	0.055	0.082	0.972	12.951**	-0.019		10.626**		
Random slope	12.366	5	0.030	0.101	0.970	12.976**	-0.019 (-0.189)		11.021**	0.352	
Fixed quadratic	4.422	4	0.352	0.027	0.998	13.346**	-0.951** (-0.230)	0.304** {---}	11.255**	0.417	
Random quadratic[#]	1.244	1	0.265	0.041	0.999	13.303**	-0.938** (N/A)	0.302** {N/A}	5.681	-5.034	-0.116

Random quadratic with slope fixed to zero	**4.170**	**4**	**0.384**	**0.017**	**0.999**	**13.341****	**-0.952**** (---)	**0.304**** {-0.200} [---]	**11.156****		**0.054**

	χ^2	*df*	*p*	RMSEA	CFI	Mean			Variance		
						Intercept	Slope	Quadratic	Intercept	Slope	Quadratic
<u>Absorption</u>											
Null model	262.575	9	0.000	0.442	0.011	10.451**					
Random intercept	**4.041**	**8**	**0.853**	**0.000**	**1.000**	**10.470****			**12.662****		
Fixed slope	3.885	7	0.793	0.000	1.000	10.403**	0.044		12.666**		
Random slope	1.389	5	0.926	0.000	1.000	10.399**	0.047 (0.095)		11.587**	0.279	
Fixed quadratic	1.354	4	0.852	0.000	1.000	10.373**	0.113 (0.096)	-0.022 {---}	11.586**	0.278	
Random quadratic#	0.139	1	0.709	0.000	1.000	10.383**	0.111 (N/A)	-0.02 {-0.851} [N/A]	8.348	-2.622	0.128

	χ^2	*df*	*p*	RMSEA	CFI	Mean Intercept	Mean Slope	Mean Quadratic	Variance Intercept	Variance Slope	Variance Quadratic
Effort regulation											
Null model	192.225	9	0.000	0.376	0.000	15.149**					
Random intercept	23.910	8	0.002	0.118	0.912	15.140**			6.309**		
Fixed slope	9.044	7	0.250	0.045	0.989	15.592**	-0.351**		6.386**		
Random slope	**8.296**	**5**	**0.141**	**0.068**	**0.982**	**15.593****	**-0.351**** **(-0.015)**		**6.247****	**0.133**	
Fixed quadratic	8.248	4	0.083	0.086	0.976	15.607**	-0.413 (-0.019)	0.022 {---}	6.253**	0.135	
Random quadratic#	0.031	1	0.860	0.000	1.000	15.609**	-0.421 (N/A)	0.024 {N/A} [N/A]	2.338	-6.544	-0.723*

Note. The selected model is bolded. RMSEA = Root Mean Square Error of Approximation, CFI = comparative fit index. Values in parentheses are correlations between latent mean intercept and slope, those in braces are correlations between latent mean intercept and quadratic; values in brackets are correlations between latent mean slope and quadratic.

[#] Model is not interpretable due to negative variance(s) or residual variances.

--- indicates that correlations cannot be estimated because variance is fixed to zero.

N/A indicates that correlations cannot be estimated because of negative variances(s).

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

CHAPTER FOUR: EXAMINING THE FACTOR STRUCTURE AND VALIDITY OF THE ENGLISH PRECURSORS TO BOREDOM SCALES (Tze, Daniels & Klassen, 2014)

Students experience academic boredom more frequently than any other negative emotion (Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010). Academic boredom is highest when students are learning abstract subjects in passive ways (Larson & Richards, 1991)–a combination that many large undergraduate classes fall victim to by presenting abstract materials through didactic lectures. Perhaps it is not surprising then that about 58% of college students perceive more than half of their courses as boring (Mann & Robinson, 2009) and by extension not only experience unpleasant feelings but have a strong desire to withdraw from a situation (Pekrun et al., 2010). It is this desire to escape that distinguishes boredom from more neutral experiences such as lack of interest and makes boredom a debilitating emotion (e.g., Pekrun et al., 2010). The nature of boredom is the impetus for the current research that seeks to confirm the structure of a measurement tool to assess the precursors or causes of boredom.

Theoretical Perspective on Boredom

We used the control-value theory of emotion (Pekrun, 2006) to examine boredom because it focuses on both antecedents and outcomes of emotions and can therefore help identify sources of emotions that may be manageable by teachers, students, or the design of academic programs. In Pekrun's framework, academic boredom refers to an unsettling and tedious emotion experienced when academic activities are either far beyond or below students' capabilities (e.g., Goetz, Pekrun, Hall, & Haag, 2006). Additionally, boredom is induced if there is low subjective value of academic-related activities (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). In other words, boredom arises in response to low or high control and low value in a learning situation–a finding supported by both Canadian and German data (Pekrun et al., 2010). Instructors may knowingly or unknowingly create situations of high or low control and value. For example components of a learning environment such as instructional quality or enthusiasm are positioned as distal causes of academic emotions in Pekrun's theory because they are the basis for students' control and value appraisals. Thus these types of variables provide excellent source of information on construct validity related to causes of boredom. By extension, boredom may exert an effect on objective outcomes such as achievement as well as subjective experiences like efficacy. Thus these types of variables provide an excellent source of criterion validity for precursors of boredom.

Causes of Boredom

To systematically investigate precursors to boredom in school settings, Daschmann, Goetz, and Stupnisky (2011) borrowed from the literature on boredom at work and developed the Precursors to Boredom Scales (PBS). The PBS includes eight theoretically and empirically distinguishable precursors to boredom: being over-challenged (over-challenge), being under-challenged (under-challenge), being bored by an unchanging routine (monotony), not finding meaning in learning (lack of meaning), having better things to do than be in class (opportunity costs), disliking the teacher (teacher dislike), feeling uninvolved (lack of involvement), and being bored by the general situation (general boredom tendency). Each precursor theoretically exerts a different impact on students' academic behaviours.

The structural and construct validity of the PBS (Daschmann et al., 2011) was evaluated using multi-level confirmatory factor analysis and comparing three models: a one-factor model with all causes loaded on one latent factor, an eight-factor model with discrete latent causes of boredom, and a higher-order model with eight latent causes loaded on one common latent construct. The eight-factor model demonstrated the best fit with data and was retained. Next, Daschmann et al. examined how the scale related to various measures of instructional quality. They found that all precursors except under-challenge correlated positively with poor quality of instruction (e.g., punishing for failure), and negatively with enthusiasm, practical application, and usefulness of learning.

Because the PBS was conceptually based on broad categories of causes for work-related boredom (e.g., Martin, Sadlo & Stew, 2006), the items are largely non-specific to age groups or populations. There is little reason to think that the content of the items measuring the causes of boredom would be inappropriate for college students. Supporting this, Conrad (1997) found that when college students were asked about boredom in lectures they suggested it was because of "under-stimulation", "hav[ing] no knowledge about [the content]", seeing "no point", "repetitive" format, and general sense of it being "a waste of time" (pp. 471-472). These causes of boredom correspond to Daschmann and colleagues' factors of being under-challenged, being over-challenged, lack of meaning, monotony, and opportunity costs (see Mann & Robinson, 2009 for similar parallels). Therefore, although the PBS was developed to measure causes of boredom in young students its underlying dimensions are applicable to university settings.

Outcomes of Boredom

Boredom is negatively associated with students' educational development (Pekrun et al., 2010), including dropping out (Wegner, Flisher, Chikobvu, Lombard, & King, 2008), juvenile delinquency (Newberry & Duncan, 2001), truancy (Sommer, 1985), and increased suspension rates in gifted students (Kanevsky & Keighley, 2003). Two proximal outcomes may be self-efficacy for self-regulated learning (SESRL) and achievement. SESRL is defined as one's beliefs about using self-regulated learning strategies for academic success (Pajares, 2002; see also Zimmerman, 1989, 1994). SESRL would be classified as an outcome of boredom, specifically motivation to learn, in Pekrun's (2006) theory. Although research has shown that boredom is negatively associated with self-efficacy (e.g., Artino, La Rochelle, & Durning, 2010) and self-regulated learning strategies (e.g., Pekrun, Goetz, Titz, & Perry, 2002; Pekrun et al., 2011), it is important to take into consideration an individual's confidence to regulate his or her learning (Pajares, 2002; Zimmerman, Bandura, & Martinez-Pons, 1992). In particular, being equipped with regulatory skills in learning is insufficient to succeed (Zimmerman et al., 1992); students also need to have efficacy beliefs to monitor and evaluate their progress, put effort into accomplishing the task, and apply appropriate strategies to attain their goals (Bandura, 1986). These reasons together make it important to consider SESRL in relation to boredom, and more specifically the causes of boredom. Given that efficacy extends from mastery experiences (Bandura, 1994), such experiences may be lacking in an achievement setting characterized by high control. It is expected that sources of boredom related to high control and low value may have negative influence on SESRL.

Furthermore, the experience of academic boredom has a surprisingly large negative associationwith achievement. Across several studies the correlation between boredom and achievement, measured by final grades or GPA, appears to be between -.15 and -.32 (Daniels et al., 2008; Daniels et al., 2009; Pekrun et al., 2010, 2011). Specific to causes of boredom, Daschmann and her colleagues (2009) found lack of meaning, opportunity costs, over-challenge, lack of involvement, teacher dislike, and general boredom tendency correlated negatively with achievement. Their findings suggest the importance of managing students' perceived causes of boredom in order to potentially alleviate its negative impact on achievement. However, most research on boredom has been cross-sectional rendering it impossible to determine the direction of the relationship between boredom and achievement. As much as achievement may impact boredom so too are there other precursors that need to be identified and these are the focus of the current research.

Purposes of the Studies

Because the PBS was developed in Germany with students in Grades 5 to 10, its generalizability to other populations needs to be established. Therefore, we designed two studies that focused on precursors to boredom. In Study 1 we evaluated the psychometric properties and construct validity of the English Precursors to Boredom Scales (E-PBS) in a sample of Canadian undergraduate students. We also compared the E-PBS to the original PBS with German students to determine equivalence across the groups. In Study 2 we replicated the factor structure and examined criterion-related evidence between specific precursors to boredom and SESRL and academic achievement.

Study 1

We tested the validity of the E-PBS in a Canadian college sample by examining its factor structure, internal consistency, and construct validity. We expected that the E-PBS would demonstrate the eight-factor structure reported in Daschmann et al. (2011) and be invariant with the original sample. We included three components of the learning environment on which students base their control and value appraisals as validity measures: enjoyment, instructional quality, and agitation. We expected (1) negative correlations between enjoyment of class and monotony, opportunity costs, and lack of involvement (2) all precursors to correlate positively with the measure of poor quality of instruction and (3) positive correlations between agitation and boredom due to over-challenge, lack of meaning, dislike of the teacher, and general boredom tendency.

Method

Participants and procedure. A total of 274 Canadian university students (21% male and 73% female, with 6% not reporting their gender) completed one online questionnaire requiring approximately 30 minutes. Participants were part of a participant pool, were invited through class announcements, and received course credit. Participants could stop the survey at any time without penalty and instructors had no access to study. Although the survey had several questionnaires, only those related to the E-PBS and the validation constructs (enjoyment, instructional quality, and agitation) were used in these analyses. Of the 274 participants, there was 6% missing data. Participants' ages ranged from 18 to 52 years old ($M = 23.13$, $SD = 5.50$).

Translation process. The translation of the German PBS (Daschmann et al., 2011) to English followed conventional procedures (e.g., van de Vijver & Leung, 1997): It was translated into English by bilingual experts and then back translated by different bilingual researchers to ensure that the meaning and content were equivalent to the original scale.

Measures

Precursors to boredom. The translated Daschmann et al.'s PBS (2011) was used to measure eight precursors to boredom through 22 items. A common statement (i.e., "When I am bored in class it is because …") was followed by causes of boredom (e.g. "the subject matter is too difficult for me."). Participants responded on a 5-point scale (1 [*strongly disagree*] to 5 [*strongly agree*]). Consistent with Daschmann et al., the eight causes showed moderate to good reliabilities, with Cronbach's αs ranging from .84 to .94 (see Table 4.1 for descriptive statistics and all reliability coefficients for Study 1).

Learning environment variables. We used individual items measuring levels of enjoyment, poor instruction, and agitation to establish construct validity. Participants responded on 5-point scale (1 [*strongly disagree*] to 5 [*strongly agree*]). These items were chosen based on achievement emotion theory (Pekrun, 2006) and previous research (e.g., Daschmann et al., 2011).

Rationale for Analyses

First, we used AMOS 18.0 (Arbuckle, 2009) to test if the structure of the E-PBS best fit a one-factor, eight-factor, or higher-order solution (Daschmann et al., 2011). For the two most common fit indices (Jackson, Arthur, & Purc-Stephenson, 2009), we set cut-offs for CFI ≥ .90 as adequate and ≥ .95 as good and RMSEA ≤ .08 as adequate and ≤ .05 as good (e.g., Blunch, 2008; Brown, 2006). We used full information maximum likelihood (FIML) to derive parameter and standard error estimations based on incomplete data (Graham, 2009) with the understanding that analyses may not be biased with ≤ 10% missing data (Bennett, 2001).[1] Second, to examine if item loadings were invariant across the Canadian and original German samples, we used ten Berge's (1986) approach that involves comparing the percentage of variances. Differences of less than 10% according to average phi coefficient across independent studies indicate factorial invariance. We also compared the correlations and reliabilities between the E-PBS and the original PBS. Third, we calculated latent correlations for validity evidence.

Results[2]

Factor structure and invariance. Consistent with Daschmann et al.'s (2011) findings, our results indicated that the eight-factor model represented an adequate fit with the data and was a better fit than either of the other two models (Table 4.2). Although the higher-order model approached acceptable fit indices, we chose to retain the eight-factor model because it was more parsimonious.[3] Table 4.3 presents the item loadings of each precursor on its corresponding factor. Item loadings ranged from .63 to .98, indicating moderate to high loading, *p*s < .05. Daschmann et al. (2011) reported 34.21% of variance and our model explained 33.22% resulting in a difference of 2.9% and suggesting factorial invariance between the E-PBS and the original PBS.

Internal consistency. The Cronbach's αs of the precursors in this study were in the high consistency range, from .84 to .94, suggesting that the E-PBS is an internally consistent measure (Table 4.1). Interestingly, the latent intercorrelations between lack of meaning and being under-challenged ($\phi = .27$, $p <.01$) and between opportunity costs and being under-challenged ($\phi = .20$, $p <.01$) were in an opposite direction as to those found in Daschmann et al. Similarly, such a reverse pattern of results was also found between being under-challenged and lack of involvement ($\phi = .23$, $p < .01$; $r = .10$, $p >.05$) and between being under-challenged and teacher dislike ($\phi = .24$, $p < .01$; $r = .04$, $p > .05$). A non-significant relationship was revealed between being over-challenged and under-challenged ($\phi = .02$, $p > .05$.). Despite the above differences, the remaining 23 latent intercorrelations were in the same direction and similar magnitude between our study and Daschmann et al.'s (2011) study. Of particular interest, lack of involvement and teacher dislike showed the highest latent intercorrelation in both studies, $\phi = .82$, $p < .01$.

Construct validity. Table 4.4 displays the bivariate correlations between each precursor to boredom, the levels of enjoyment, dissatisfaction with instruction, and agitation. Consistent with Daschmann et al.'s (2011) findings, all eight precursors to boredom were significantly and negatively correlated with dissatisfaction with instruction. The eight precursors to boredom were also positively correlated with levels of agitation. In addition, enjoyment negatively correlated with three antecedents to boredom, which weremonotony and opportunity costs, and general boredom tendency.

Brief Discussion

Study 1 showed that the original eight-factor structure of the PBS adequately fit our data. The findings suggest that the causes of boredom are similar at two education levels and in Canada and Germany. Moreover, the scale functioned similarly in the two countries as evidenced by few differences in terms of item loadings, good convergent/divergent validity on similar variables, and similarly strong internal consistencies. Where differences emerged, a few explanations come to mind. One of possible reasons might be inherent differences in grade schools and post-secondary institutions. The former often has prescribed curricula to follow and students are expected to meet a particular standard (e.g., passing a provincial examination) in order to graduate. The latter usually provides more flexibility for students to choose courses and programme of study that are of interest to them, and students assume the responsibility to meet not only university standards but also requirements of their prospective careers. For example, grade school students might find it meaningful to know how to apply "under-challenging" materials to their homework, whereas post-secondary students might consider no reason to sit through under-challenging lectures that do not match with their levels of learning. Therefore, it is not surprising to find the difference between the Canadian and German samples on being under-challenged and lack of meaning. Another possible explanation might be related to a wider range of challenges embedded in a university subject, whereas a grade-level subject might be more refined in scope of challenges. This might help to explain about the observed difference in our two samples. University students might experience both under-challenging tasks and over-challenging tasks over a course of study and hence a linear relationship might not be easily found between the two constructs, whereas, with more refined scope and level of challenge in a grade-level subject (e.g., Grade 5 Mathematics), students might be less ambivalent about which level they are at. In other words, a clearer distinction between over-challenged and under-challenged could be made for younger students.

Overall, the E-PBS provides researchers with a useful measure to assess precursors to boredom in the English-speaking populations and with older students. This is the first step in creating a tool that can be used by instructors to identify and help mitigate sources of boredom.

Study 2

The purpose of Study 2 was to replicate the factor structure established in Study 1 using a new sample and to examine criterion-related validity between precursors to boredom, SESRL and achievement. We hypothesize that (1) causes of boredom due to over-challenge, teacher dislike, lack of meaning, involvement, opportunities costs, and tendency would be negatively correlated with SESRL; (2) causes of boredom due to under-challenge or monotony would be positively associated with SESRL and (3) that all causes of boredom, except under-challenge, would negatively correlate with achievement.

Method

Participants and procedure. A total of 172 students (44 males and 128 females) were recruited through the same participant pool mechanism as in Study 1 at one Canadian university and completed an online questionnaire. There was 3% missing data. The mean age of the participants was 22.29 years old (*SD* = 4.33). Students completed the questionnaire in the middle of a semester and we collected students' final grades in the course directly from their instructors.

Measures

Precursors to boredom. The E-PBS was used to assess causes of boredom. Descriptive statistics and correlations for all variables in Study 2 are presented in Table 4.5.

Self-efficacy for self-regulated learning. SESRL[4] was measured with seven items from Usher and Pajares's (2008) study. Each item began with the common statement "How confident are you that you can …" and was followed by a regulatory strategy (e.g. "finish assignments by deadlines?"). Participants responded on a 7-point scale, 1 (not well at all), 5 (quite well), and 7 (very well).

Academic achievement. Final course grades were used to assess academic achievement. Instructors provided us with final grades on a 4.0 system. Of the 105 participants who consented to release their grades for this study, there were 14% with a grade of 4.0, 15% with 3.7, 15% with 3.3, 9% with 3.0, 22% with 2.7, 14% with 2.3, 7% with 2.0, 3% with 1.7, and 1% with 1.0.

Rationale for Analyses

We conducted a CFA in AMOS 18.0 (Arbuckle, 2009) to confirm the measurement model of the E-PBS. We set the same goodness-of-fit criteria as in Study 1: CFI ≥ .90 as adequate and ≥ .95 as good and RMSEA ≤ .08 as adequate and ≤ .05 as good (e.g., Blunch, 2008; Brown, 2006). Next we examined criterion-related validity by correlating the precursors to boredom, SESRL, and achievement in Statistical Package for Social Sciences.

Results

Measurement model. Replicating the findings in Study 1, the E-PBS displayed an adequate fit to the data for the eight-factor model (Table 4.2), with a small proportion of missing data (i.e., 3%).

Criterion-related evidence. As shown in Table 4.5, causes of boredom due to being over-challenged, lack of meaning, opportunity costs, and general boredom tendency negatively correlated with SESRL. Interestingly, causes of boredom due to being under-challenged, monotony, teacher dislike, and lack of involvement did not relate significantly to SESRL. These findings were partially in line with our expectations. Contrasting to Daschmann et al.'s (2011) finding of significant negative correlations between precursors to boredom and students' math grades, in our study only boredom due to under-challenge showed a significant relationship with final course grades, $r = .22$, $p < .05$.

Brief Discussion

The CFA corroborated our findings from Study1 regarding the structure of the E-PBS. We also gathered evidence on the criterion-related validity of the eight precursors to boredom. Four precursors to boredom, which were being bored due to over-challenge, opportunity costs, lack of meaning, and general boredom tendency, were associated with lower levels of SESRL. Although these particular results make sense, we had expected similar results for more of the precursors of boredom including under-challenge, monotony, teacher dislike, and lack of involvement. In explaining these unexpected non-significant results two ideas come to mind. First, it is possible that students may still perceive themselves as able to regulate easy, under-challenging, monotonous activities even though they may compromise perceptions of control or value. Second, teacher dislike and lack of involvement, although unpleasant, may not prevent students from gaining the mastery experiences that give rise to SESRL (Bandura, 1994). The most logical explanation for the minimal relationships with academic achievement extends from differences in sample characteristics between Daschmann et al. (2011) and our work. Daschmann et al. examined low, intermediate, and high achieving students, whereas our university sample likely reflects only high achieving students. By extension, university students may value highly achievement and therefore simply not allow any particular precursor to boredom to undermine their achievement (Linnenbrink & Pintrich, 2002).

General Discussion and Conclusions

We focus our general discussion on two main points: First, the structure of the E-PBS was confirmed in a college level North American sample. Second, the causes of college students' boredom relate predictably to their perceptions of the learning environment.

Structural Validity and Utility of the English Precursors to Boredom Scales

By confirming the factor structure of the English-Precursors to Boredom Scale in two separate samples of Canadian university students we have established the E-PBS as a suitable measurement tool. In addition to the structural integrity of the tool, our results suggest invariance with the original PBS and thereby indicate that students in two countries and at different levels of schooling appear to attribute their boredom to the same categories of causes. In other words, the source of boredom is much the same whether students are children or young adults and are in mandatory or elective schooling. Having a validated tool to examine the causes of boredom is a necessary first step in reducing boredom by identifying its source.

By understanding why students' feel bored in the first place, both teachers and students can take ownership of boredom. First, teachers may target the specific reasons for boredom and thus modify their instruction in ways that may be more successful in reducing students' levels of boredom. Second, by knowing the source of their boredom students can make decisions about ways to cope with the boredom themselves (Nett, Goetz, & Daniels, 2010). In this way the responsibility for alleviating boredom can be shared by teachers and students once the root is identified. One area for future research may be to determine if the E-PBS is a suitable measurement tool for teachers' perceptions of the causes of their students' boredom and whether or not teachers are able to accurately identify the sources of their students' boredom. Some research suggests that teachers' judgements are in sync with only certain components of classroom behaviour (Lee & Reeve, 2012) and whether or not boredom and its causes fall into this category remains an empirical question.

The Relationship between the E-PBS and Instruction

The E-PBS functioned similarly in Canada as in the original German sample as evidenced by strong internal consistency and adequate validity evidence with a variety of measures related to instruction. Understanding the relationship between the E-PBS and instruction provides a starting place for potential intervention. Although instructors may try various "interesting" activities aiming to get students enjoy a class or lecture, students may still experience boredom due to other reasons, such as not finding meaning. Consistent with Dashmann et al.'s (2011) findings, our results indicated that focusing on the quality of a course and its usefulness would be a good starting point to mitigating multiple sources of boredom. This type of advice may be particularly useful for instructors who may feel overwhelmed by the sheer number of potential causes of students' boredom. This approach of focusing on a few robust causes is not only logical but pedagogically sound. Nonetheless, further research is needed to evaluate how good quality instruction of a well-designed course alleviates the eight causes of boredom and to examine the extent to which each of these causes reflects a loss of control or value in the learning environment.

The Relationship between the E-PBS, SESRL and Achievement

We found negative correlations between self-efficacy for self-regulated learning (SESRL) and four precursors to boredom: over-challenge, lack of meaning, opportunity costs, and general boredom tendency. Thus these antecedents appear to be problematic sources of boredom among university students. We acknowledge that the causal direction of these relationships cannot be determined from our data; however, we interpret our results from the perspective of the control-value theory of emotions that suggests precursors to boredom would influence SESRL and achievement. From this perspective, the results are fairly intuitive: When learning tasks are beyond students' capabilities boredom may reflect the fact they are overwhelmed and they may not know how to regulate their learning. Students who feel that they have better things to do than to be in class and that their learning lacks meaning, might allow their boredom to disengage them from learning thereby reducing their levels of confidence to self-regulate when they are required to re-engaged. Finally, students who enter a learning situation prone to boredom may doubt their ability to self-regulate. Documenting the negative effect of these causes may help students take responsibility for boredom stemming from these causes. If they can reappraise their perceptions of over-challenge, lack of meaning, and opportunity costs students may see an associated increase in their SESRL and decrease in the occurrence of boredom. Moreover, it is important to remember that students empowered with SESRL may be better able to manage boredom when it does arise.

Although these precursors impaired students' SESRL, they did not exert a negative impact on their objective achievement. In fact, contrary to Daschmann et al. (2011) no precursor impaired students' achievement levels. One reason for this may be that college students are simply so driven to achieve that they can "work through" their boredom. Another explanation is found in sources of boredom that suggest the learning environment is not that difficult. For example, boredom that stems from under-challenge or monotony is part of a low-demands learning environment that may simply not require high levels of SESRL to negotiate. In terms of implications, this might suggest that although these causes of boredom may indeed cause students to feel bored, aside from experiencing this negative emotion other decrements to SESRL or achievement may be negligible. This represents an interesting addition to the literature that to date has only shown boredom as bad for achievement (Daniels et al., 2008; Pekrun et al., 2010).

Limitations and Future Research

Our results need to be considered in light of three limitations. First, participants came from a participant pool drawing from two different large required undergraduate lectures. Given that causes of boredom could be induced due to situational factors and interaction between personal and environment factors (Fisher, 1993), differences in subject matter (namely educational psychology versus educational technology) and the use of instructional strategies may have influenced participants' responses. Future research should evaluate causes of boredom in a particular subject, which aligns with the domain specific nature of academic boredom (e.g., Goetz, Frenzel, Lüdtke, & Hall, 2011).

Second, the eight-factor E-PBS is an *adequately fitting model* but not an ideal fitting model. The adequacy of the fit might be related to our modest sample sizes. Third, we are also limited by a one-time collection of exclusively self-report data and little demographic information about our participants. Given that data were obtained from a single source, a common method variance may influence the study's construct validity (Drost, 2011). Thus, future research may consider re-evaluating the scale using a larger sample, collecting data from multiple sources (e.g., instructor's ratings and behavioural observations), and examining potential confounding variables, and in other learning contexts to replicate the findings. Although our cross-sectional data is sufficient to answer our research questions, future research may consider using longitudinal designs to examine the trajectory of causes of boredom over time.

Implications for Research and Practice

As Mann and Robinson (2009) discuss, college students frequently report feeling bored in lectures. Although educators have noticed this emotion and incorporated a number of "interesting" learning components in their teaching, their practices may not alleviate students' boredom. The gap may lie in different causes of boredom. The present study extends previous research on boredom by validating the causes of boredom among university students and highlighting those that are most troubling. Specifically, four causes of boredom, namely over-challenge, lack of meaning, and opportunity costs correlated, negatively with SESRL and thus are empirically supported starting places to reduce boredom at its source.

Reducing boredom by reducing boredom caused by over-challenge falls primarily on the shoulders of instructors. Teachers need to be sensitive to the demands their class places on students. Overwhelming students with a lot of reading and assignments may create an environment that triggers boredom and associated decreases in ability to self-regulate. Teachers can gain information about the workload of their course by simply asking students and then making adjustments to their course. Instructors and students share responsibility for reducing two sources of boredom —opportunity costs and lack of meaning. For instructors, this may mean focusing on the relevance of their material to students' lives by linking it to recent events, potential career opportunities, and everyday functions. For students, reducing boredom from these causes involves committing to the course and being willing to *look* for meaning (e.g., making connections between values of taking the course and implications to their lives). In particular, Nett et al. (2010) found that students who coped with boredom by cognitively reappraising the situation, essentially finding meaning in an otherwise boring situation, had the most adaptive learning profile. Teaching students to reappraise might be one way to help reduce their boredom. In fact, reappraisal may even help reduce general boredom proneness. In conclusion, strategies instructors use to help reduce students' boredom coupled with students taking responsibility for the source of their boredom may be key to reducing boredom based on a variety of causes.

Footnotes

[1] Because we had a small amount of missing data we did not want to delete, we used full information maximum likelihood (FIML) to derive parameter and standard error estimations based on incomplete data in both Study 1 and Study 2. For comparison purposes, we used listwise deletion and re-ran the analyses on a reduced sample that contained only complete data (Graham, 2009). We did not find meaningful differences between the two methods for either study.

[2] Before proceeding to the main analyses in Study 1 and 2 we examined our data for multivariate normality using Mardia's coefficient. In both instances our data appear to be multivariate normal according to Bollen's (1989) criterion that Mardia's coefficient not exceed p(p+2), where p equals the number of observed variables: Study 1 Mardia's coefficient = 163.77 < 22(22+2); Study 2 Mardia's coefficient = 89.42 < 22(22+2).

[3] Having determined essentially no differences for the full sample or the reduced sample with full data, we chose to conduct all remaining analyses with full data only.

[4] The scale showed adequate reliability ($\alpha = .79$) and validity (*r* with GPA = .33) in previous studies (e.g., Klassen et al., 2010).

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Table 4.1. Descriptive statistics, reliability and latent interrcorrelation matrix in Study 1 and Daschmann et al. (2011)

	M^*	SD^*	α	1	2	3	4	5	6	7	8
1 Monotony (n=3)	2.90 (2.50)	1.25(1.00)	.90 (.69)	--	.58**	.42**	.21**	.58**	.59**	.48**	.18**
2 Lack of meaning (n=4)	2.32 (2.23)	1.18(1.00)	.93 (.81)	.46***	--	.50**	.41**	.27**	.57**	.49**	.19**
3 Opportunity costs (n=2)	2.71 (3.57)	1.22(1.21)	.92 (.80)	.47***	.72***	--	.22**	.20**	.27**	.24**	.33**
4 Being over-challenged (n=4)	2.26 (2.30)	1.08(0.95)	.90 (.79)	.36***	.65***	.49***	--	.02	.33**	.32**	.23**
5 Being under-challenged (n=2)	2.86 (2.27)	1.22(1.08)	.94 (.72)	.32***	-.28***	-.24***	-.49***	--	.23**	.24**	.06
6 Lack of involvement (n=2)	2.25 (1.96)	1.30(1.07)	.91 (.76)	.53***	.44***	.38***	.56***	-.07	--	.82**	.16*
7 Teacher dislike (n=2)	1.95 (2.15)	1.13(1.32)	.92 (.88)	.46***	.45***	.41***	.43***	-.08	.75***	--	.20**
8 General boredom tendency (n=3)	1.66 (1.97)	0.75(0.89)	.84 (.70)	.56***	.60***	.61***	.29***	.10*	.34***	.36***	--

Note. Numbers in parentheses represented values in Daschmann et al.'s (2011) study and non-parentheses numbers represented values in this study. The upper diagonal represented the latent intercorrelations of E-PBS in this study and the lower diagonal represented the latent intercorrelations of PBS in Daschmann et al. M^* and SD^* represent the averaged item mean and standard deviation. N = 257-274

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4.2. Precursors to Boredom Scales fit indices of models

	Study 1: $N_{(FIML)} = 274$; $N_{(listwise)} = 257$					Study 2: $N_{(FIML)} = 172$; $N_{(listwise)} = 166$				
	χ^2	*df*	*p*	CFI	RMSEA	χ^2	*df*	*p*	CFI	RMSEA
One-factor model	3,101.83	209	<.01	.412	.225	1,914.52	209	< .01	.303	.218
	(3,065.22)	(209)	(<.01)	(.414)	(.231)	(1,914.12)	(209)	(<.01)	(.308)	(.222)
Higher-order	663.99	200	<.01	.906	.092	389.09	200	< .01	.923	.074
model	(654.06)	(200)	(<.01)	(.907)	(.094)	(389.01)	(200)	(<.01)	(.923)	(.076)
Eight-factor model	467.95	179	<.01	.941	.077	286.22	179	< .01	.956	.059
	(470.12)	(179)	(<.01)	(.940)	(.080)	(286.169)	(179)	(<.01)	(.957)	(.060)

Note. CFI = Comparative Fit Index, RMSEA = Root-Mean-Square Error of Approximation. Values on the top rows represent fit indices using Full Information Maximum Likelihood to handle missing data, and those in parentheses represent fit indices using listwise deletion method to handle missing data.

Table 4.3. Item loading of each precursor to boredom in Study 1 and Daschmann et al. (2011)

	F1	F2	F3	F4	F5	F6	F7	F8
We do so many similar types of exercise	.84 (.57)							
We always do the same thing in class	.90 (.69)							
My instructor always says the same thing	.86 (.72)							
The subject matter in class has no meaning in my life		.83 (.67)						
There is no reason for me to concern myself with these things		.86 (.76)						
I don't know why we learn all these things		.93 (.68)						
I won't need what we are learning in my future job		.86 (.76)						
I would much rather do something else than sit in class			.98 (.88)					
There are much better things to do than sit in class			.88 (.76)					
The subject matter is too difficult for me				.93 (.67)				
The course is just too difficult for me				.97 (.72)				
I can't follow the instructor				.63 (.77)				
My instructor explains things in a way that I do not				.64 (.64)				

understand								
The subject matter is so easy					.93 (.80)			
The subject matter in class is not challenging for me					.96 (.71)			
The instructor never involves us in the lesson						.90 (.74)		
The instructor doesn’t take an interest in the students						.93 (.83)		
I don't like my instructor							.90 (.92)	
My instructor isn't likable							.94 (.86)	
I'm always bored in school								.88 (.71)
I am somebody who is always bored								.86 (.56)
This course is just as boring as all the other subjects								.67 (.70)

Note. F1 = monotony; F2 = lack of meaning; F3 = opportunity costs; F4 = being over-challenged; F5 = being under-challenged; F6 = lack of involvement; F7 = teacher dislike; F8 = general boredom tendency. All item loadings were significant, $p < .05$. Numbers in parentheses represented item loadings in Daschmann et al.’s study and non-parentheses number represented item loading in this study. N = 257

Table 4.4. Correlations between the E-PBS, enjoyment, dissatisfaction and agitation in Study 1

	M (SD)	Over	Under	Monotony	No meaning	Costs	Dislike	Involve	General
I enjoy being in class.	3.95 (.86)	-.06	.06	-.13*	-.11	-.35**	-.10	.02	-.26**
Thinking about the poor quality of the course makes me angry.	1.96 (1.23)	.32**	.12*	.23**	.40**	.18**	.40**	.33**	.19**
Thinking about all the useless things I have to learn makes me irritated.	1.97 (1.16)	.29**	.12*	.30**	.45**	.36**	.31**	.25**	.22**

Note. Over = being over-challenged, Under = being under-challenged, No meaning = lack of meaning, Costs, = opportunity costs, Dislike = teacher dislike, Involve = lack of involvement, General = general boredom tendency. N = 255-264

* p <.05, ** p < .01

Table 4.5. Descriptive statistic, reliabilities, and correlation matrix of the E-PBS in Study 2

	α	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Being over-challenged	.87	8.95	3.97	1.00									
(2) Being under-challenged	.92	6.23	2.39	-.19*	1.00								
(3) Monotony	.87	9.57	3.39	.09	.47**	1.00							
(4) Lack of meaning	.90	10.80	4.73	.34**	.19*	.35**	1.00						
(5) Opportunity costs	.93	6.14	2.54	.18*	.09	.26**	.46**	1.00					
(6) Teacher dislike	.90	4.56	2.31	.22**	.04	.19*	.33**	.12	1.00				
(7) Lack of involvement	.87	5.20	2.43	.34**	.10	.24**	.34**	.06	.43**	1.00			
(8) General boredom tendency	.83	5.84	2.85	.15*	.04	.22**	.22**	.34**	.09	.09	1.00		
(9) SESRL	.89	55.26	11.56	-.29**	.07	-.08	-.25**	-.24**	.01	-.03	-.36**	1.00	
(10) Final course grades	---	3.01	.69	-.18	.22*	.03	.02	.05	-.12	-.14	-.10	.31**	1.00

* $p < .05$, ** $p < .01$ N =102-167

CHAPTER FIVE: GENERAL DISCUSSION AND CONCLUSION

Although academic boredom has recently gathered more research attention (e.g., Daniels et al., 2008; Pekrun, Goetz, Daniels, Stupnisky, & Perry, 2010; Tze, Daniels, Klassen, & Li, 2013), it remains important to advance our current understanding of this commonly experienced negative emotion by examining its antecedents, impacts on learning, and concurrent relationships with student engagement. This dissertation therefore fills a critical research gap by systematically evaluating core relationships depicted in the control-value theory (Pekrun, 2006) across three articles. Findings from each article are briefly summarized in the following section, followed by a discussion of results that corroborate one another, and ending with a conclusion regarding practical implications of these corroborated results, along with general limitations and proposed future research.

A Summary of Findings Revealed in The Three Articles

A brief summary of the findings from the three studies is provided to guide the reader. The first article (Tze, Daniels, & Klassen, 2014a) evaluated the extent to which academic boredom has a negative correspondence with students' learning outcomes. Results indicated an overall small-to-medium effect size between academic boredom and learning outcomes, with context playing a role in the negative correspondence; that is, boredom experienced in class had more significant negative relationship with learning outcomes than boredom experienced during studying. Furthermore, consistent with the control-value theoretical framework (Pekrun, 2006), results indicated that boredom has a more profound negative relationship with motivation than with study strategies andbehaviours, or academic attainment. Even though the effect size between boredom and academic achievement was modest, $r = -.16$, it can be considered to have practical significance given the cumulative nature of emotional experiences and time spent in educational settings.

The second article (Tze, Klassen, & Daniels, 2014) involved the examination of patterns of change of state boredom and student engagement over 12 weeks. The results advance our current understanding of boredom with regard to its trajectory, as well as its concurrent association with student engagement over a longer period of time. Specifically, boredom experienced in class increased over time, whereas boredom associated with studying for a course was relatively stable. Furthermore, although the levels of affective and cognitive engagement remained fairly consistent over time, those for motivational and behavioural engagement varied, with the former following a U-shape and the latter declining over a semester. Interestingly, there were no individual differences observed in the above change patterns. In addition, the pattern of increasing levels of boredom experienced in class was associated with both the U-shape pattern of change for motivational engagement and the declining pattern observed in behavioural engagement. Lastly, results revealed a significant negative prediction from perceived autonomy support on students' experience of boredom in class.

The third article (Tze, Daniels, & Klassen, 2014b) sought to validate the English Precursors to Boredom Scales (E-PBS) and aimed to shed light on the factors that contribute to students' experience of boredom. The eight antecedents—being over-challenged, being under-challenged, monotony, lack of meaning, lack of involvement, opportunity costs, teacher dislike, and general boredom tendency (Daschmann, Goetz, & Stupnisky, 2011)—included in the E-PBS were not only validated in both studies involving two independent samples, but also positively correlated with both poor quality of instruction and experience of agitation. Some unexpected results were also found regarding the relationships between precursors to boredom and self-efficacy for self-regulated learning (SESRL) and between each precursor and academic achievement. Only four precursors—being over-challenged, lack of meaning, opportunity costs, and general boredom tendency—were negatively correlated with SESRL, and except for being under-challenged, the remaining precursors showed non-significant relationships with academic achievement.

Corroborated Findings Across Studies

Boredom is a common emotional experience among students, and its impact on students' learning cannot be taken lightly. The results, when taken together, indicate the importance of understanding the reasons why students are bored during academic-related activities before pertinent strategies and interventions to mitigate this negative emotion can be designed and implemented. This dissertation, as a whole, also provides several over-arching findings. First, the negative relationship between boredom and student learning/engagement was consistently found; second, the influence of context in the experience and impact of boredom was a thread running through all three studies; and third, the antecedents to boredom, both distal and proximal factors, and the negative associations between antecedents and learning were common to Chapters 3 and 4.

Aversive effect of being bored. Consistent with previous studies (e.g., Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011) that often measured boredom at only one time point, the results in Chapters 2 and 3, in which meta-analytical technique and multi-wave designs were used, respectively, not only provide congruent support but also strengthen the finding of the negative effect of being bored on learning. More specifically, results of the meta-analysis on academic boredom provide further support for the aversive effect on learning outcomes. Despite some variation in effect sizes, the negative association was shown across contexts, age groups, and types of academic outcomes. Although there have been discussions regarding some potential benefits of being bored, such as being more creative and seeking a more meaningful goal (e.g., Belton, 2008; Bench & Lench, 2013; Mann & Cadman, 2014), a coherent pattern of empirical results is missing for this finding. By contrast, the negative influence of being bored, particularly in educational settings, is further supported by a simultaneous increase of boredom and a decrease of effort regulation revealed in Chapter 3. Hence, it is not surprising to observe the overall negative association between boredom and learning outcomes, as was found in the meta-analysis.

Context plays a role. In the academic boredom literature, boredom in class/lecture and during studying are the two contexts which are usually considered. However, a direct comparison of the two settings is rarely made. Results of Chapter 2 revealed a more negative influence of being bored in class than during studying. This may be in part related to a less restrictive environment when a student studies, as was discussed. When results of Chapters 2 and 3 are taken together, another possible explanation emerges. Class-related boredom increases over time, whereas learning-related boredom stays fairly consistent over time. In light of the negative influence of being bored and given the potential cumulative effect, it is not surprising to see a more negative impact on learning outcomes from being bored in class than during studying. However, it is important to indicate that this interpretation is somewhat speculative because findings in Chapter 3 were based on a university sample while results in Chapter 2 included secondary students. Further research is needed to replicate findings in other student populations, such as elementary students, and in other cultural settings.

Antecedents to academic boredom. Knowing what contributes to academic boredom is as important as understanding the effects of being bored during achievement activities. Hence, Chapters 3 and 4 examined the factors that contribute to boredom. It was found that perceived autonomy support, as a distal factor, was inversely associated with students' level of class-related boredom. Providing students with autonomy support can be considered as an important and necessary instructional strategy (e.g., Dachmann et al., 2011). With this in mind, it makes sense to find a positive relationship between poor quality of instruction and all eight precursors to boredom. Taken together, these findings indicate the importance of providing quality of instruction and support for students' sense of autonomy in learning. This effort may potentially reduce causes of boredom as well as class-related boredom itself.

Practical Implications of This Dissertation

When the results are considered together, a common practice-related theme emerges: boredom is not a trivial emotion and is different from lack of interest or motivation, thereby deserving of further attention. In light of findings revealed in this dissertation, a logical question is what educators and students can do to minimize boredom. In the following section, practical implications— 1) increasing the awareness of academic boredom, 2) intervening at classroom level, and 3) tracking the causes of boredom—are discussed.

Raising awareness and understanding of academic boredom. It is understandable that teachers have complex demands, including responding to individual students' questions, managing a classroom in an orderly fashion, and making sure that certain topics are covered etc. As was discussed in Williams-Johnson et al.'s (2008) study, teachers take different approaches to manage students' emotional responses ranging from detachment, avoidance, and responsive styles. Thus, it is not surprising to see that boredom may receive less attention in classroom settings due to its non-disruptive nature (e.g., Pekrun et al., 2010). However, results of this dissertation clearly indicate the need to increase educators' and students' awareness of the aversive influence of boredom on learning. Although boredom examined in this dissertation is not a pathological disorder, its negative effect on a number of learning outcomes (motivation, study strategies and behaviours, and achievement) and across contexts and age groups cannot be ignored. Much can be accomplished to inform post-secondary instructors and older students to be cognizant to the aversive impact of being bored and to see the importance of addressing this negative emotion. Based on our results, one good starting place is in the classroom.

Targeting class-related boredom. Regardless of whether it is an emotionally close and intensive elementary class, a dispersed secondary school setting (e.g., Hargreaves, 2000), or a large university class, academic boredom exists as long as students perceive a lack of value and either overwhelmingly high or low control of a given learning activity (Pekrun, 2006). Given that most topics taught in class and learning activities are decided by teachers, this leaves little room for students to develop a sense of control. As was revealed in the findings, class-related boredom has a more negative effect on student learning outcomes and it increases over time. To mitigate the negative influence as well as to intervene in an increase in classroom boredom, students should be encouraged to actively combat boredom. Nett, Goetz, and Daniels (2010) found the more students endorsed the use of cognitive-reappraisal strategies, the lower the frequency of boredom; the strategies included being more attentive and actively looking for the importance of being in class. Tze et al. (2013) also found that students who primarily endorsed the use of cognitive-reappraisal strategies reported a lower level of boredom (i.e., the overall mean score was lowered than the scale mean). In other words, a student has to be cognizant of his/her boredom and be able to identify a proactive strategy to reduce boredom. For example, consider a third-year university student who becomes bored when her instructor is going over Vygotsky's social development theory, a theory already taught in another course. To lower boredom, this student can try to focus on the importance of reviewing the key concepts and remind himself/herself that it is an opportunity to check for understanding. Nett et al. also found that it may be helpful to lower the levels of boredom when students use behavioural-approach coping strategies. Similarly, Tze et al. found that students who primarily endorsed behavioural-approach coping strategies might cope similarly well as those who embraced a cognitive-reappraisal approach to cope with boredom. For instance, in the previous scenario, the third-year university student can try to ask the instructor if he/she could work on a project to research how Vygotsky's theory applies to another context (e.g., in a foster home), or translates to appropriate teaching practices. This scenario relies on the student to come up with concrete, specific, and learning-related alternatives. Teachers should also take some responsibilities because they are in the position to *control* types of learning activities and assessments, the depth of inquiries on a variety of topics, and the means to deliver a course. This can be achieved by providing autonomy support for students, such as allowing students to choose ways to demonstrate their knowledge, and by carefully linking topics taught to practical relevance to students' lives. Another avenue is to identify sources of boredom when it arises and to intervene accordingly.

Understanding the causes of academic boredom. Despite educators' efforts to incorporate a variety of interesting topics and activities, students may still experience boredom. This may likely be related to different causes of boredom. For instance, one student may be bored because he already knows how to do univariate analysis, whereas in the same class, another student who is struggling to understand what standard deviation means becomes bored because he does not know how to begin. The E-PBS provides a useful tool for educators as well as for students to understand reasons contributing to the experience of boredom in educational settings. The results from this study highlight three potential avenues for post-secondary instructors to intervene: providing an optimal level of challenging activities, identifying the means for students to master a particular concept, and helping students to see the importance of attending lectures. For post-secondary students, the E-PBS not only could serve as self-monitoring tool to see how one attributes causes of boredom but also could pinpoint avenues for intervention on students' side. For example, obtaining high scores on being over-challenged and opportunity costs, a student might choose to do a self-reflection, e.g., "Do I put sufficient amount of effort in preparation? What else do I miss in understanding the fundamental concepts? How can I close this gap? What can I do to better grasp the information taught in class? Shall I review my notes on a more regular basis?" etc. Helping students to understand the eight antecedents to boredom could be a first step of intervention through recognition, and they could subsequently take some responsibilities to identify adaptive coping strategies.

General Limitations and Future Research Directions

While results of this dissertation have addressed some gaps in the academic boredom literature, a few limitations across the three articles are worth noting, and more work is clearly needed. First, this dissertation research is limited by the use of students' self-report data in Chapters 3 and 4, and similarly, the studies included in Chapter 2 primarily relied on self-report data when assessing the level of academic boredom. This also indicates a general limitation as well as a challenge in the academic boredom research. As Vogel-Walcutt, Fiorella, Carper, and Schatz (2012) discussed, physiological sensors that assess the level of boredom are often intrusive, and thereby they may not fit the purpose of measuring students' academic boredom in an authentic classroom setting. Future research should explore whether there is a coherent set of observable and measurable features of academic boredom. Facial recognition and gaze tracking techniques may provide some help but may not be sufficient, and considering other manifestations of boredom, such as vocal, physical, and situation cues, simultaneously may be a possible avenue to pursue.

Second, although the E-PBS was validated using a university sample, it is important to replicate this result in elementary and secondary school student populations so that educators can have a reliable and valid measure to screen causes of their students' boredom and adjust accordingly. Furthermore, despite gaining a better understanding on the influences, the patterns, and causes of boredom at the post-secondary level in this dissertation research, there is still a lack of understanding of how boredom affects primary and secondary school students. In particular, as was revealed in Chapter 2, there were only seven studies examining the association between secondary students' boredom and their learning outcomes and one study investigating such a relationship among primary students. In contrast, there were 22 studies investigating the effect of boredom on learning at the post-secondary level. Our current understanding of academic boredom, particular in English speaking populations, is largely based on university students' responses. In order to have a more comprehensive knowledge about academic boredom, researchers should consider examining how this negative emotion develops, and is expressed and managed in younger student populations, such as elementary and secondary school students.

Third, despite the use of different sophisticated analytical techniques in this dissertation research, our results do not assume any causal relationships among antecedents, boredom, and learning outcomes. Further research should consider conducting authentic experiments to identify the causal directions. Having said so, as quality of instruction is inversely related to empirically supported antecedents to boredom, as revealed both in our results and in Daschmann et al.'s (2011) study, researchers should also consider furthering this line of investigation to identify what constitutes good quality of instruction at each school level, and which instructional aspects are important to prevent the occurrence of academic boredom. Lastly, mitigating the negative spiral effect of being bored is as important as preventing it. Although initial efforts of identifying adaptive boredom coping categories are underway, future research should focus on developing practical coping strategies that can be easily implemented and taught in classrooms and at age-appropriate levels.

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