Validating Critical Assumptions of the Control-Value Theory of Emotion

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ABSTRACT

Despite increased salience of achievement emotions in psychological theory and research, emotion research remains in a state of fragmentation (Pekrun, 2018). Pekrun's (2006) control value theory of emotion (CVT) is an integrative appraisal-based framework for understanding the antecedents and consequences of achievement emotions. CVT incorporates perspectives from theories of perceived control (Perry, 1991), attribution theory (Weiner, 1985, 2018), achievement goal theory (Elliot et al., 2011), and theories of self-regulated learning (Fredrickson, 2001; Pintrich et al., 1994). However, critical assumptions of CVT remain untested. This dissertation aimed to validate critical yet overlooked assumptions of CVT, with a focus on synthesizing disparate motivation constructs within a CVT framework. I conducted three separate but interconnected studies with this focus. Study 1 tested CVT's assumption concerning the interactive relationship between control and value appraisals predicting achievement emotions.

Study 1 extended prior research (Bieg et al., 2013; Shao et al., 2020) by incorporating principles of Weiner's attribution theory to examine if students' initial test performance in a novel competitive learning environment moderates Control × Value interaction effects on discrete emotions. Results support both CVT and attribution theory. Control and value interacted to predict enjoyment, boredom, hope, pride, anxiety, shame, anger, regret, and helplessness. Consistent with attribution theory, students' initial achievement outcomes moderated the interactive effects of appraisals on negative outcome-emotions (e.g., shame, anger), such that control and value were crucial for maintaining adaptive levels of emotions following perceived academic setbacks (i.e., test failure).

Study 2 incorporated salient constructs within achievement goal theory with CVT by testing a central CVT assumption that appraisals of control and value mediate relationships between achievement goals and emotions (Pekrun et al., 2006, 2009). Mastery-approach goals predicted increased perceived academic control (PAC), and value. Performance-approach goals predicted

decreased value over two semesters. Cognitive appraisals were related to enjoyment, boredom, and anxiety which, in turn, predicted achievement in the two-semester course.

Study 3 focused on CVT's assumption of reciprocal causation between cognitive appraisals, emotions, and achievement. Study 3 extended prior research (Pekrun et al., 2014, 2017) by incorporating theories of self-regulated learning to better align with CVT's proposed model. A regression-based path model demonstrated a reciprocal appraisal-emotion-learning-achievement temporal sequence across two semesters. This research strengthens understanding of the antecedents and outcomes of achievement emotions, clarifies reciprocal motivational processes between cognition, emotion, and achievement, and aids in the development of interventions to foster adaptive achievement emotions. Further, this research advances efforts towards theory integration, an essential requirement for building cumulative scientific knowledge (Elliot et al., 2023; Eronen & Bringmann, 2021; Wigfield & Koenka, 2020).

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CHAPTER 1

Validating Critical Assumptions of the Control-Value Theory of Emotion

Lifecycle transitions such as moving to another city, starting a new career, and age-onset health declines involve diverse motivation challenges and setbacks (Hamm et al., 2019; Heckhausen et al., 2010, 2019). The K-16 education system entails numerous upheavals of the learning environment. School-to-college transitions are particularly momentous. School-college shifts are infused with challenges that include unfamiliar learning conditions, increased academic competition, unexpected personal responsibilities, debt, unstable social networks, and critical career choices (Perry, 2003; Perry et al., 2005). Over 25% of college students fail to reach their second year, and only 60% attain their degree within 6 years (De Brey et al., 2021). Almost 90% of Canadian college students have felt overwhelmed by their studies, 50% have experienced hopelessness, and 10% have contemplated suicide (American College Health Association, 2016).

Compounding threats to mental health and emotional well-being are unpredictable global events such as the COVID-19 pandemic that forced postsecondary institutions worldwide to convert their academic programs to remote delivery platforms (Liu et al., 2020; Wilson et al., 2021). These abrupt shifts away from traditional learning environments exacerbate feelings of uncertainty, anxiety, and helplessness, and deplete positive emotions such as hope, among others (Sahu, 2020). A comprehensive theory-based understanding of cognitive, affective, and motivation processes activated during rapidly changing learning conditions is needed to bolster the emotional well-being and motivation of struggling students. The need for methodologically robust tests of socio-cognitive theory is emphasized by the recent replication crisis in psychological science (Open Science Collaboration, 2015).

Theory and Replication in Social Psychology

Solutions to the limited scientific fidelity in social psychology initially focused on improving methodological practices (Nelson et al., 2018; Shrout & Rodgers, 2018), or identifying contextual factors which may have led to replication failures (Świątkowski & Dompnier, 2017; Van Bavel et al., 2016). However, a growing number of scholars now suggest that the replication crisis is merely a symptom of the proliferation of ad hoc studies that lack an established theoretical foundation (Elliot et al., 2023; Eronen & Bringmann, 2021; Muthukrishna & Henrich, 2019). Further, theory-derived empirical studies rarely connect to or build upon other theories. This has led to disparate bodies of social psychology research that cannot support or synthesize with other theories in their subfield. As such, social psychology often fails to develop the cumulative scientific knowledge which characterizes disciplines such as the natural sciences (Muthukrishna & Henrich, 2019).

Research focused on validating established theories of social cognition is needed to ameliorate these issues in social psychological research (Eronen & Bringmann, 2021). This requires applying rigorous methodological practices to empirical tests of explicit, falsifiable theoretical propositions. Further, integrating disparate social-cognitive constructs within a unified theoretical framework is essential for building cumulative scientific knowledge (Elliot et al., 2023). Rather than invalidating and replacing prior research, theories which incorporate and build upon past theory are better situated to provide a consolidated framework for understanding and explaining human behavior. Pekrun's (2006; 2018) control value theory (CVT) of achievement emotions may provide such a framework for understanding the antecedents and effects of emotions in competitive achievement settings.

CVT is a contemporary appraisal-based theory of achievement emotions and motivation that incorporates principles of prior social-cognitive theories of emotion, including Fredrickson's (2001) broaden-and-build theory of positive emotions, expectancy-value theory (Turner & Schallert, 2001), and Weiner's (1985, 2014, 2018) attribution theory. Appraisal-based theories of emotion are founded on the premise that individuals' perceptions (appraisals) of events determine their emotions, rather than the events themselves (Heider, 1958).

Control-value Theory: A Contemporary Appraisal Theory of Emotion

Achievement Emotions: Definitions and Effects. Emotions are defined within CVT as coordinated processes between psychological networks including cognitive, affective, expressive, physiological, and motivational systems (Shuman & Scherer, 2014). Achievement emotions are those tied directly to achievement activities and outcomes (Pekrun, 2006, 2018). CVT organizes achievement emotions within a 2 × 2 × 2 dimensional taxonomy to categorize the wide array of discrete emotions experienced in competitive achievement settings, more than 15 discrete achievement emotions have been reported (Pekrun et al., 2002). Emotions can be categorized within a taxonomy according to their subjective valence (positive vs. negative), physiological activation (activating vs. deactivating), and whether they are tied to achievement activities or outcomes (activity emotions vs. outcome emotions).

Positive activating emotions (e.g., enjoyment, hope) are posited to facilitate learning and motivation by promoting self-regulation and flexible learning strategies, reinforcing adaptive academic behaviors, and bolstering attention and working memory resources. Negative deactivating emotions (e.g., boredom, helplessness) are proposed to have the opposite effect on learning and motivation. The consequences of negative activating emotions (e.g., anxiety, shame) on these processes are less clear. These emotions are hypothesized to reduce well-being,

enforce rigid approaches to learning, and disrupt attention, but may motivate academic engagement as a strategy to avoid failure (Pekrun & Perry, 2014). Cross-sectional (Dewaele et al., 2018, King et al., 2015), longitudinal (Parker, Perry, Chipperfield, et al., 2018; Pekrun et al., 2010), person-centered (Parker et al., 2021), large-scale (Lee, 2014; Tze et al., 2021), and meta-analytic studies (Camacho-Morles et al., 2021; Lei & Cui, 2016; Tze et al., 2016) support CVT's proposed effects of emotions within the 2 × 2 × 2 taxonomy (see Pekrun & Perry, 2014; Shao et al., 2019 for reviews).

Appraisals and Emotions. The central tenet of CVT is that socio-cognitive appraisals (perceptions) of control and value over achievement activities and outcomes are the strongest, and most proximal, instigators of discrete emotions. The theory states that achievement emotions are induced when an individual perceives they have control, or lack control, over activities and outcomes that are subjectively important, or unimportant (Pekrun, 2006; Pekrun & Perry, 2014).

Perceived (personal) control refers to the subjective appraisal of one's ability to influence and predict outcomes and events across the lifespan (Heckhausen et al., 2010; Perry, 1991; Skinner, 1996). The domain-specific construct of perceived academic control (PAC) is commonly utilized in education research (Perry et al., 2001; 2005). Meta-analytic studies show that control constructs (e.g., academic control, academic self-efficacy) are the strongest psychosocial predictors of college achievement and GPA (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017). According to CVT, PAC promotes positive emotions and reduces negative emotions by facilitating expectations and experiences of success and competence (Pekrun & Perry, 2014). Research corroborates CVT's proposed relationships between PAC and discrete emotions.

PAC reliably shows positive effects on positive-outcome emotions (e.g., hope, pride), and negative effects on negative outcome-emotions (e.g., anxiety, shame, helplessness) of magnitudes ranging from moderate-to-large (Chipperfield et al., 2017; Hall et al., 2016; Perry et al., 1997; 2001; Shao et al., 2020; Stupnisky et al., 2013; Turner et al., 2002). Relationships between academic control and activity emotions show the same pattern according to emotion-valence. PAC predicts higher levels of enjoyment, and lower levels of boredom. However, these relationships are typically of weaker magnitude compared to outcome-emotions (Buhr et al., 2019; Niculescu et al., 2015; Parker, Perry, Chipperfield et al., 2018; Tze et al., 2021). Longitudinal randomized-treatment field studies demonstrate that control-enhancing interventions indirectly promote adaptive levels of discrete positive and negative emotions through increased PAC (Dryden et al., 2023; Hamm et al., 2017; Parker, Perry, Hamm et al., 2018).

Perceived value (importance) consists of intrinsic value—the appraised value of an achievement activity or outcome in and of itself, irrespective of other outcomes— and extrinsic value—the perceived instrumental utility of an activity or outcome for the attainment of other goals. Within CVT, value is proposed to amplify both positive and negative achievement emotions. The theory states that individuals who appraise achievement activities and outcomes as highly valuable will experience greater intensity of emotions during activities and following success and failure outcomes than those who do not perceive achievement as being valuable. However, CVT specifies one caveat regarding the otherwise positive relationships between value and emotions. Feelings of boredom are posited to be strongest when achievement activities are perceived as having little or no value (Pekrun, 2006; Pekrun & Perry, 2014).

Intrinsic value is a strong negative predictor of boredom and positive predictor of enjoyment (Frenzel et al., 2007; Goetz et al., 2020; Noteborn et al., 2015; Putwain et al., 2018; Tze et al., 2021). Extrinsic and general measures of value demonstrate similar relations with boredom and enjoyment (Bieg et al., 2013; Buhr et al., 2019; Parker et al., 2021; Pekrun et al., 2010). Intrinsic and extrinsic value are positive predictors of hope and pride, with magnitudes ranging from small-to-moderate (Bieg et al., 2013; Goetz et al., 2010; Shao et al., 2020). For negative outcome-emotions (e.g., anxiety, shame, helplessness), the pattern of relationships is ambiguous. Intrinsic value shows weak negative or non-significant effects on negative-outcome emotions (Frenzel et al., 2007; Goetz et al., 2020; Lauermann et al., 2017). Extrinsic value demonstrates weak positive associations or non-significant relationships with anxiety and shame (Bieg et al., 2013; Frenzel et al., 2007; Lauermann et al., 2017), as do general academic value scales (Goetz et al., 2006; Hall et al., 2016; Parker et al., 2021; Shao et al., 2020).

Underexamined Assumptions of Control-value Theory

Despite recent advances in the CVT literature, foundational theoretical assumptions of CVT remain underexamined. This dissertation is composed of three interrelated studies each focused on empirically validating one of these assumptions. The first assumption concerns the multiplicative relationship between PAC and value as determinants of emotions. Stated differently, PAC and value are assumed to have interactive effects on achievement emotions. The second assumption pertains to the proximal relationship between PAC and value appraisals with emotions. Motivation constructs such as achievement goals are posited to be distal determinants of emotions relative to PAC and value, and thus influence emotions indirectly through changes in these appraisals. The final assumption refers to the reciprocal relationships between appraisals, emotions, learning strategies, and achievement. Although CVT proposes

how a linear temporal sequence of psychosocial constructs determines motivation, it incorporates cyclical feedback loops in this sequence to explain, for instance, how achievement outcomes can influence appraisals. These studies provide evidence to validate critical yet overlooked assumptions of CVT by testing theory-derived hypotheses using a world-class database. This dissertation advances knowledge by providing a strong foundation of scientific and theoretical rigor on which further research and understanding can be built.

Critically, the theoretical perspectives advanced within this dissertation yield evidenced-based strategies for enhancing the efficacy and/or methodological paradigms for implementing theory-based treatment interventions. There is a growing body of literature focused on socioemotional motivation treatments grounded in CVT, or those which target important constructs within CVT. However, these treatments rarely target more than a single psychosocial factor of motivation (Cromley et al., 2020; Harackiewicz & Priniski, 2018).

Motivation Treatments and Control-value Theory

There are two major categories of motivation treatments which incorporate perspectives and/or constructs relevant to CVT. The first category focuses on enhancing students' appraisals of the value of course-related learning and/or academic achievement; the second category is designed to bolster students' perceptions of academic control (Tze et al., 2022). For value-based interventions, studies typically focus on increasing students' perceived utility-value of learning and achievement (Rosenzweig et al., 2022). Utility-value refers to the perception that academic tasks and outcomes are useful, relevant, or otherwise important for immediate or long-term goals (Canning et al., 2018). Within CVT, utility-value is regarded as a component of extrinsic value (Putwain et al., 2023).

Hulleman et al. (2010) conducted two studies aimed at improving perceived utility-value for undergraduate students enrolled in an introductory psychology course. The first study was conducted in a laboratory setting. Students received instructions for how to implement cognitive strategies in mathematical problem solving. Students in the experimental condition then wrote a brief essay about how these skills could be applied to their studies or daily lives. The intervention increased students' reported utility-value of the problem-solving strategy, relative to the control group. The strongest treatment effect was observed for students with low GPAs, or those with low expected math performance. However, the intervention did not directly increase scores on a post-intervention math worksheet, and showed no indirect effects via utility-value. The second study was conducted in an ecologically relevant introductory psychology classroom setting. Approximately halfway through the one-semester course, students assigned to the experimental condition wrote similar brief essays pertaining to how psychology course content was relevant to their lives. The writing-based treatment boosted students' utility value, which in turn predicted higher final grades in the introductory psychology course.

Canning et al. (2018) extended the utility-value intervention research paradigm in a sample of 2nd-year undergraduate biology students. Specifically, they administered three experimental utility-value writing exercises throughout the course, and assessed the effects of treatment timing according to students' prior GPA. They found that the writing exercises increased students' utility-value of biology, which in turn predicted higher course grades, as well as increased persistence and enrollment in the next biology course in program sequence. Notably, students with low prior GPAs benefitted most from completing a writing exercise early in the course, whereas students with higher GPAs benefitted most from the intervention when administered near the end of the course.

Kosovich et al. (2019) implemented a relatively brief utility value intervention in a community-college introductory math course. The authors administered a single utility-value exercise, which pertained to reading quotes from former students about how they have applied the course content to their own lives. They found that the brief intervention increased students' perceived utility-value of math. The intervention also improved overall pass rates for the course, but only for male students.

Rosenzweig et al. (2019) conducted a utility-value intervention study focused on assessing the impact of student choice on treatment efficacy. The high choice condition allowed introductory biology students to choose whether to write an essay or a letter to a friend or family member pertaining to the utility-value of biology. The low choice condition instructed to students to write an essay, and the control condition instructed students to summarize course content. The authors found that students in the high choice condition had higher utility value relative to the low choice and control conditions, whereas the low choice condition had no effect on utility-value compared to the control condition. The high choice condition showed indirect positive effects on course grades and subsequent course enrollment via enhanced utility-value. Lazowski & Hulleman's (2016) meta-analysis of motivation interventions showed that utility-value based interventions had an average standardized effect size of 0.39 on objective achievement outcomes. This effect is slightly lower in magnitude than interventions designed to enhance students' academic control.

The majority of control-based interventions focus on cognitive restructuring or reframing techniques (Perry & Hamm, 2017). Students typically watch brief videos or read handouts detailing how shifting one's causal attributions for failure from uncontrollable causes (e.g., "I'm not smart enough for university") to controllable causes (e.g., "I need to use more effective study

strategies to prepare for tests") leads to positive motivation and achievement outcomes. These attribution-based interventions, known as attributional retraining (AR), were originally developed according to the principles of Weiner's (1985) attribution theory. Within CVT, causal attributions are a component of perceived academic control (Pekrun, 2006).

Wilson and Linville (1982) conducted the first attributional retraining (AR) intervention study involving young adults, and twice replicated their original results within three years (1985). Their experimental treatment condition consisted of videotaped interviews with senior undergraduates who discussed how their grades improved after their first year. In the control condition, participants watched interviews with senior undergraduates who did not discuss their grades. Across all three studies, the researchers found that participants in the treatment condition had significantly increased their GPAs and had higher rates of persistence than those in the control condition. This AR treatment was designed to encourage the belief that low GPAs were caused by unstable factors that would improve over time. This treatment was later developed to directly focus on supporting control-enhancing cognitions.

Perry and Penner (1990) examined the moderating role of locus of control on AR treatment effects in a laboratory-based study that afforded well designed experimental controls. Their experimental condition consisted of showing students an eight-minute video of a psychology professor explaining the adaptive value of attributing unsatisfactory academic outcomes to low effort, and attributing successes to a combination of high ability and high effort. For students with a high external locus of control, the treatment had positive effects on test scores administered immediately after treatment, and on another test administered one week later.

When administered in competitive learning environments with high ecological validity, AR shows efficacy for enhancing academic control, achievement emotions, performance, and persistence for students with a wide range of baseline psychosocial characteristics which may put them at risk for academic failure. These factors include initially low levels of deep learning strategies, low academic control, high stress, and low initial course performance (Hamm et al., 2017; Haynes-Stewart et al., 2006; Parker et al., 2016, 2018; Perry et al., 2010). AR has also demonstrated efficacy for enhancing these motivation and performance outcomes for students with sociodemographic risk characteristics, including first-generation students, and students in debt as a result of tuition costs (Dryden et al., 2021, 2023). Lazowski & Hulleman's (2016) meta-analysis showed that control-enhancing attribution-based interventions had an average standardized effect size of 0.54 on objective achievement outcomes.

Research has advanced theory-based interventions designed to either enhance students' perceptions of utility-value or academic control. However, incorporating perspectives from CVT may provide further opportunities to optimize motivation treatment efficacy and their methodological paradigms. These perspectives concern salient research questions such as to what extent do the salutary effects of academic control depend on value, and vice versa? How are classroom- or student-based efforts to alter students' achievement goals expected to change control and value appraisals? And, how might an intervention targeting a single motivation factor alter the process of a reciprocal feedback loop between all motivation factors? Each of the three interrelated studies detailed below aims to empirically validate a central assumption of CVT. This represents a crucial step towards answering these questions.

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CHAPTER 2

Study 1

Academic Control, Value, and Initial Achievement: Interactive Effects on Achievement Emotions

CVT posits that achievement emotions are a joint function of individuals' appraisals of perceived control and value, such that specific combinations of control and value determine experiences of discrete emotions. Research supports the interactive effects of control and value proposed by CVT (Bieg et al., 2013; Shao et al., 2020), but this assumption remains underexamined. Moreover, CVT-focused studies have overlooked how important events within the learning environment such as achievement outcomes may contribute to emotion. Achievement outcomes are central to Weiner's (1985, 2014, 2018) attribution theory of emotion and motivation, a progenitor of CVT. The purpose of this study is to replicate the interactive effects between control and value on emotions, and integrate principles of CVT with attribution theory by examining if students' initial test performance in a novel competitive learning environment moderates the impact of the Control × Value interaction on discrete emotions.

The extant research demonstrates that control and value appraisals are powerful emotional antecedents. Control may to be a stronger predictor of outcome emotions and a weaker predictor of activity emotions relative to value (Parker et al., 2021). A critical assumption of CVT concerns the synergistic or multiplicative effects of control and value appraisals on discrete emotions. Beyond the independent effects of perceived control and value on emotion, CVT posits that specific combinations of appraisals arouse specific discrete emotions. The intensity of achievement emotions grows stronger with increasing control, for positive emotions, and lack of control for negative emotions, as accompanied by increasing value.

Consider anxiety as an illustrative example. According to CVT, when achievement is highly valued, students who perceive a lack of control will feel highly anxious over the threat of academic failure; students who perceive control over their academic success will have low anxiety. In contrast, when achievement is not perceived as valuable or important, the effects of control are attenuated. Regardless of having high or low perceptions of control, students who do not value achievement are expected to have low anxiety because they are not concerned with the consequences of success and failure.

Interactive Effects of Appraisals on Emotion.

Although the synergistic relationships between control and value are critical to CVT, this assumption has been largely overlooked in empirical research, with a few notable exceptions. Goetz et al. (2010) used an experience-sampling intraindividual analytic approach to examine interactive effects between control and value as predictors of enjoyment, pride, and contentment in a sample of German university students. They found positive interactive effects for each emotion, indicating that the positive effects of control on positive emotions grew stronger with increasing value.

Nie et al. (2011) used a between-subjects approach with a large sample of sixth grade students in Singapore to examine the interactive effects between control and value. In support of the study's primary hypothesis, the perceived importance of achievement interacted with students' academic self-efficacy to predict levels of test anxiety. Notably, the importance of test achievement positively predicted anxiety at low and average levels of self-efficacy, but at high levels of self-efficacy this maladaptive relationship was nullified. This 'buffering' effect of control-related constructs with value in predicting anxiety was subsequently replicated in

samples of American elementary school students and Korean secondary school students (Lauermann et al., 2017; Song & Chung, 2020).

Bieg et al. (2013) used intraindividual analyses to test Control × Value interactions predicting achievement-related pride, anxiety, and boredom in a sample of German high school students. The researchers successfully replicated the positive interaction predicting pride, and found negative interaction effects for the negative emotions, such that the negative effects of control on boredom and anxiety increased with value. Consistent with CVT, students with low control and high value experienced the most anxiety. Notably, at low levels of value, control was a positive predictor of boredom.

Putwain et al. (2018) extended this research through a longitudinal latent analytic approach. The authors examined the multiplicative effects of control and value predicting boredom and enjoyment in a sample of English primary school students. They found that the interaction effect predicted activity emotions beyond the effects of prior enjoyment and boredom. Differences between the effects of control at low (−1 SD) vs. high (+ 1 SD) value were substantial. At low value, control had no effect on enjoyment, and predicted higher levels of boredom. At high value, control had a positive effect on enjoyment, and the positive relationship between control and boredom was reduced to non-significance. Putwain et al. (2021) extended this research to include anxiety, and by separating value into the subcomponents of intrinsic value, attainment value, and utility value. This study revealed a single interaction effect between perceived control and intrinsic value predicting enjoyment. This effect was opposite to those found in past studies, such that the salutary relationship between control and enjoyment became weaker as value increased.

Shao et al. (2020) used a latent-variable approach to test appraisal interactions for enjoyment, boredom, hope, pride, anxiety, shame, anger, and hopelessness in a sample of Chinese first-year university students. They found positive interaction effects for each positive emotion, and negative interaction effects for each negative emotion. Finally, Putwain et al. (2023) took a unique approach to testing appraisal interactions. The authors focused on underexamined achievement emotions including relief, gratitude, anger, and disappointment as well as anxiety. Secondary school students' emotions were assessed in the context of their high-stakes examinations being canceled in response to the COVID-19 pandemic. For relief and gratitude, an interaction emerged such that negative control-emotion relationships became stronger as value increased. For anger, an interaction effect showed that the positive relationship with control became stronger as value increased.

Three salient limitations underscore theory-testing research focused on Control × Value interactions. First, with few exceptions, studies overlook the wide range of discrete emotions experienced in achievement settings by limiting focus to only a select few emotions (Pekrun et al., 2002). Second, findings are often framed exclusively around academic control as the focal independent variable. This is not problematic in-and-of itself, as interaction effects are symmetrical (Hayes, 2018), and CVT specifies that the effects of value are dependent on control just as the effects of control depend on value. However, the consistent focus and graphical depiction of control as the focal variable and value as the moderator may obscure how value-emotion relationships differ between levels of control. These relationships are arguably more informative in an interaction context, as they clarify when higher value is salutary for emotional health, and when it is maladaptive.

Third, prior studies have neglected to examine if the effects of control, value, and their interaction may also depend on other critical predictors of achievement emotions such as students' performance outcomes (Perry et al., 2010). Testing these 3-way interactions may contribute substantially towards theory integration, as achievement outcomes are a cornerstone of the motivation and emotion processes proposed within Weiner's (1985, 2014, 2018) attribution theory.

Emotions and Achievement: Perspectives from Attribution Theory

Weiner's (1985, 2014, 2018) attribution theory proposes a temporal process of cognition and emotion to account for an individual's motivation and achievement. Weiner posits that these processes are initiated by unexpected, negative, and/or important outcomes (e.g., poor test performance). Attribution theory frames motivation and emotion processes around the causes (attributions) individuals ascribe to these events. Identifying a specific cause for an outcome fulfills a basic human need to understand one's environment.

The motivational impact of causal attributions can be predicted according to attribution theory's three-dimensional taxonomy of causes: locus of causality (internal-external), stability (stable-unstable), and controllability (controllable-uncontrollable). Uncontrollable causes of achievement setbacks (e.g., low ability) are maladaptive and instigate helplessness because they reflect beliefs that nothing can be done to improve future outcomes. In contrast, controllable attributions for setbacks (e.g., low effort, poor strategy) are adaptive. These attributions arouse feelings of hope for future success and increased effort-striving because they reflect the belief that future success is achievable (e.g., study more, use different study strategies).

Within CVT, causal attributions are a component of perceived control. Maladaptive patterns of causal reasoning reduce perceptions of academic control, whereas adaptive

attributions bolster control. Research demonstrates positive associations between academic control and adaptive (controllable) attributions, and negative associations with maladaptive (uncontrollable) attributions (Perry, 2003; Perry & Dickens, 1984; Perry et al., 1989, 2001). Longitudinal randomized intervention studies show that a theory-based cognitive reframing motivation treatment known as attributional retraining increases academic control through adaptive change in causal attributions (Dryden et al., 2021; Hamm et al., 2017). Evidence suggests that students are prone to maladaptive patterns of causal reasoning during school-to-college transitions (Perry et al., 2008).

Within CVT's taxonomy of achievement emotions, the object-focus distinction (activity vs. outcome) implies that outcome-emotions are, in part, determined by students' performance outcomes. Relationships between academic success with positive outcome-emotions such as pride and happiness, and between academic failure with negative outcome-emotions such as anger and shame are among the most robust findings in achievement emotion research (Weiner, 2018). Attribution theory does not address activity-focused emotions, as the proposed motivation process is initiated by achievement outcomes. Perceived academic setbacks (e.g., test failure) are crucial within attribution theory. Following academic success, individuals are assumed to experience positive emotions and stay motivated, largely independent of their attributions for success. However, in response to a perceived academic setback, a person's attributional mindset is the critical determinant of whether they will lose motivation, or have the emotional resilience to persist with renewed effort-striving. As such, the synergistic effects of control and value on emotion, particularly outcome-emotions, may depend on negative, unexpected, and important events such as poor initial performance in a novel competitive learning environment.

Study Aims and Hypotheses

This study aims to correct for the limitations of prior research on Control × Value interactions by examining interaction effects on a wide array of discrete emotions (enjoyment, boredom, hope, pride, anxiety, shame, anger, regret, helplessness) using a large-scale multi-cohort sample of college students. Interactions will be framed symmetrically, allocating focus to role of both control and value as moderators. Further, the current study seeks to integrate principles of CVT and attribution theory by examining if the interactive effects of control and value on emotion are moderated by initial achievement outcomes. Hypotheses are as follows:

H1: Control positively predicts positive emotions and negatively predicts negative emotions (1a). Value positively predicts all emotions expect boredom (1b). Test performance positively predicts positive outcome emotions and negatively predicts negative outcome emotions, and does not predict activity emotions (1c).

H2: Control and value interact in predicting emotions above and beyond their additive independent effects. Control-emotion relationships depend on levels of value, value-emotion relationships depend on levels of control.

H3: control, value, and test performance interact in predicting outcome emotions above and beyond their additive independent effects. The Control × Value interaction predicting outcome emotions depends on test performance (3a) but does not depend on test performance in predicting activity emotions (3b).

Method

Participants

Newly enrolled students (N = 6541) in a two-semester, online introductory psychology course at a research-intensive university in western Canada participated in this multiple-cohort

field study. This sample comprised five separate cohorts of introductory psychology students from the years 2014-19, who participated as part of a course assignment. The majority of students were in their first year of studies (70.5%), spoke English as their first language (76.0%), identified as female (63.1%), and were between 17-18 years old (58.1%).

Procedure

Data collection occurred during two phases of each academic year. In *Phase 1* at the start of Semester 1 (October), questionnaires were administered each year via a secure online platform, approximately one week after students received feedback on their first course test. Test 1 feedback represents an important initial academic outcome expected to initiate motivation processes, in keeping with Weiner's theory. Perceived control, perceived value, age, gender, and emotion data were collected during *Phase 1*. In *Phase 2*, upon completion of the course (May), students' objective achievement data on the first course test were obtained through institutional records. This study used data from a larger 25-year project on student motivation and academic achievement (MAACH; see Hamm et al., 2020; Perry et al., 2008; Perry, Hladkyj et al., 2005; Perry, 2003). Multiple-item scales for positive and negative outcome-emotions, except anxiety, were not available in the MAACH archive. The project was approved by the institution's Psychology and Sociology Research Ethics Board. All students provided consent for their questionnaire and achievement data to be used for research purposes.

Independent Variables (see Table 1 for *M*s, *SD*s, *α*s)

Perceived Academic Control (PAC). Students indicated their perceived control over achievement outcomes via an eight-item PAC scale (e.g., "The more effort I put into my courses, the better I do in them;" Perry et al., 2001, 2005). Four negatively worded items were reverse coded (e.g., "My grades are basically determined by things beyond my control and there is little I

can do to change that"). The scale had good psychometric reliability (Cronbach's α = .80), consistent with the PAC literature (Cronbach's α range = .75 – .81, test-retest correlation range = .58 – .67, Hall et al., 2006; Haynes et al., 2006; Pekrun et al., 2010; Perry et al., 2001; Ruthig et al., 2009; see Appendix A).

Perceived Value. Students reported their perceptions of the course's value via a six-item course-specific version of Pekrun & Meier's (2011) academic value scale ("In general, learning about the issues raised in this course is very useful for me."). The scale had good psychometric reliability (Cronbach's α = .84), as found in prior studies (Dietrich et al., 2015; Parker et al., 2021; Tze et al., 2021; See Appendix B).

Test 1 Feedback. Students' grade (%) on the first course test was provided by the instructors (with student permission) upon completion of the course. This was the first of six non-cumulative multiple-choice exams covering topics from three unique chapters of an introductory psychology textbook and accompanying class lectures. The initial performance data represented students' actual Test 1 performance as a percentage metric.

Dependent Variables

Enjoyment, Boredom, Anxiety. Students rated their experience of enjoyment ("I enjoy doing my assignments"), boredom ("This course bores me to death"), and anxiety ("I worry my assignments might be too difficult") in the course via five-item scales adapted from Pekrun et al.'s (2011) Achievement Emotions Questionnaire (AEQ). These measures had good psychometric reliability (Cronbach's α range = .76 – .88), in accordance with the AEQ literature (Buhr et al., 2019; Frenzel et al., 2007; Pekrun et al., 2011; see Appendices C-E).

Single-item Emotions. Students' feelings of hope, pride, shame, anger, regret, and helplessness in the course were assessed through single-item measures, a common practice in

achievement emotion research (Ainley & Patrick, 2006; Daniels et al., 2009; Perry et al., 2008, 2010, See Appendix F).

Covariates

Age. Students reported their age using a 10-point scale (1 = *17–18*, 10 = *older than 45*).

Gender (Semester 1). Students self-reported their gender (0 = *female*, 1 = *male*).

Cohort. Students' course cohort was coded via a 5-point scale (1 = *2014-15*, 5= *2018-19*).

Results

Rationale for Analyses

First, bivariate relationships between all measures were assessed through Pearson correlation coefficients. Primary analyses were conducted with moderated multiple OLS regression models, in which control, value, Test 1 (%) and all interactions between appraisals and test feedback were evaluated simultaneously in separate regression models for each discrete emotion. These model specifications allowed for tests of four interactions, Control × Value, Control × Test 1 (%), Value × Test 1 (%), and a higher-order Control × Value × Test 1 (%) 3-way interaction. The simple-slopes (effects) of control on achievement emotions were measured at each combination of low (– 1 SD) and high (+ 1 SD) levels of value and Test 1 (%). The simple-slopes of value on discrete emotions were measured at each combination of low and high levels of control and Test 1 (%). Low, average, and high Test 1 (%) scores correspond to letter grades of F-D, C+, and B+, respectively based on the course's grading distribution.

These simple-simple regression slopes yielded 8 conditional effects between control and value, and permitted direct tests of hypotheses based on the full sample and the entire variance in the design. Continuous variables were standardized prior to analyses. The binary predictor

gender was left in its original metric to facilitate interpretation (0 = *female*, 1 = *male*). Conditional effects are presented as fully standardized (β) regression weights. All analyses controlled for cohort using the PROCESS cluster function (Hayes, 2018), age, and gender. Statistical significance was confirmed if zero fell outside 95% confidence intervals through a bootstrap procedure based on 5000 samples of the standardized beta weights.

Zero-order Correlations (see Table 1).

Pearson product-moment correlation coefficients estimated bivariate relationships between the study variables. Academic control had moderate-to-strong positive associations with Test 1 (%) and positive outcome-emotions (e.g., hope, pride) and moderate-to-strong negative associations with negative outcome-emotions (e.g., anxiety, helplessness). Control had weak relationships with activity emotions (e.g., enjoyment, boredom). Perceived value had a strong positive association with enjoyment, and negative association with boredom, and moderate positive associations with hope and pride. Value had a weak positive relationship with anxiety, and weak negative relationships with remaining negative outcome-emotions. Test 1 (%) had a weak negative association with boredom, and was not significantly associated with enjoyment. Test 1 (%) had moderate positive associations with hope and pride, and moderate negative associations with negative outcome-emotions. Critically, weak associations between control and value (r = .12), and between Test 1 (%) and value (r = .04) suggest that students' perceived value is largely independent of their academic control and initial performance, which minimizes issues of multicollinearity in moderated regression analyses.

Table 1.
Zero−Order Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Control	—													
2. Value	.12*	—												
3. Test 1 (%)	.31*	.04*	—											
4. Enjoyment	.07*	.42*	.02	—										
5. Boredom	−.17*	−.38*	−.05*	−.26	—									
6. Anxiety	−.33*	.07*	−.12*	.03	.18*	—								
7. Hope	.35*	.33*	.23*	.30*	−.18*	−.14*	—							
8. Pride	.21*	.28*	.26*	.31*	−.16*	−.15*	.48*	—						
9. Shame	−.32*	−.07*	−.31*	−.04*	.20*	.33*	−.29*	−.36*	—					
10. Anger	−.35*	−.13*	−.26*	−.06*	.25*	.30*	−.27*	−.28*	.60*	—				
11. Regret	−.23*	−.11*	−.25*	−.05*	.23*	.29*	−.23*	−.33*	.64*	.60*	—			
12. Helplessness	−.48*	−.08*	−.28*	−.04*	.22*	.43*	−.35*	−.26*	.59*	.55*	.50*	—		
13. Age	.01	.04*	.01	.15*	−.04*	−.05*	.08*	.06*	−.04*	−.04*	−.04*	−.03*	—	
14. Sex	.07*	−.12*	.01	−.02	.09*	−.16*	.03*	.04*	−.01	.01	.00	−.06*	.07*	—
M	32.00	21.54	64.72	14.05	13.69	14.94	7.36	5.37	3.43	3.28	4.02	3.43	1.61	1.34
SD	4.99	4.56	15.78	3.71	4.76	4.79	2.09	2.45	2.64	2.64	2.89	2.44	0.88	0.51

Note. $N = 6541$. Female students coded as 0, Male students coded as 1.
* $p < .05$ (two−tailed tests).

Moderated Multiple Regressions (see Tables 2-5, Figures 1-4)

Multiple-item Achievement Emotions. For enjoyment, the Control × Value × Test 1 (%) interaction was non-significant [β = .00, p = .818, CIs = −.022 to .028], but the Control × Value interaction [β = .03, p = .013, CIs = .007 to .057], and the Control × Test 1 (%) interaction were significant [β = .04, p = .006, CIs = .010 to .060]. For students with low (− 1 SD) initial test performance, control had no effect on enjoyment at low [β = −.04, CIs = −.090 to .004] or high value [β = .01, CIs = −.033 to .062]. However, for students with high (+ 1 SD) Test 1 achievement, the effect of control increased with value, such that control positively predicted enjoyment at high value [β = .09, CIs = .037 to .144], and had no effect at low value [β = .02, CIs = −.031 to .075]. Students with high control, value, and initial performance had the highest levels of enjoyment [z = .48], students with high control, low value, and low Test 1 achievement reported the lowest enjoyment [z = −.48]. The full regression model accounted for 21% of the variance in enjoyment.

For the model predicting boredom, the Control × Value × Test 1 (%) interaction was non-significant [β = .00, p = .995, CIs = −.025 to .025]. The Control × Value effect was the only significant 2-way interaction [β = −.04, p = .002, CIs = −.067 to −.016]. Irrespective of students' initial test performance, the negative effect of control on boredom was stronger at high value [β = −.17, CIs = −.210 to −.136] than at low value [β = −.09, CIs = −.128 to −.056]. Similarly, the negative effect of value increased with control [low control β = −.32, CIs = −.353 to −.277; high control β = −.40, CIs = −.432 to −.362]. Students with low control, value, and Test 1 grades experienced the most boredom [z = .43], students with high control, value, and achievement had the least boredom [z = −.53]. The full model predicting boredom accounted for 18% of the total variance.

The Control × Value × Test 1 (%) interaction was non-significant in the model predicting anxiety [β = .02, p = .207, CIs = −.009 to .043]. However, the Control × Value interaction [β = −.04, p = .001, CIs = −.069 to −.017], and the Value × Test 1 (%) interaction were significant [β = .04, p = .005, CIs = .011 to .065]. The negative sign of the Control × Value interaction shows that the negative effect of control on anxiety increased with value. The positive sign of the Value × Test 1 (%) interaction shows that the positive effect of value on anxiety increased with Test 1 achievement. Although the higher-order 3-way interaction did not reach statistical significance, the strength of the Control × Value interaction varied with initial performance, whereby it was significant at low levels of Test 1 (%) [β = −.06, p = .001, CIs = −.094 to −.025], but was not significant at high Test 1 (%) [β = −.03, p = .191, CIs = −.065 to .130].

For students with low initial test performance, value had a positive effect on anxiety at low levels of control [β = .12, CIs = .076 to .165], but had no effect at high control [β = .00, CIs = −.052 to .058]. In contrast, for students with high Test 1 achievement, the effect of value on anxiety was positive at both low [β = .16, CIs = .100 to .229] and high levels of control [β = .11, CIs = .067 to .157]. Students with low control, high value, and high initial achievement had the highest levels of anxiety [z = .51], followed closely by those with low control, high value, and low Test 1 performance [z = .46]. Students with high control, achievement, and low value had the lowest levels of anxiety [z = −.48]. The full regression model accounted for 15% of the variance in anxiety.

Table 2.
Regression Coefficients for Multiple-item Achievement Emotions

Predictor variable	Enjoyment		Boredom		Anxiety	
	β	95% CIs	β	95% CIs	β	95% CIs
Age	.13*	.105, .154	−.03*	−.052, −.003	−.03*	−.059, −.008
Gender	.04	−.011, .091	.13*	.078, .182	−.25*	−.303, −.200
Control	.02	−.005, .047	−.13*	−.159, −.106	−.33*	−.362, −.308
Value	.42*	.394, .446	−.36*	−.382, −.330	.10*	.073., 127
Test 1 (%)	.00	−.027, .025	.01	−.021, .031	−.02	−.050, .004
Control × Value	.03*	.007, .057	−.04*	−.067, −.016	−.04*	−.069, −.017
Control × Test 1 (%)	.04*	.010, .060	−.01	−.031, .019	−.02	−.050, .002
Value × Test 1 (%)	−.01	−.034, .018	−.01	−.033, .019	.04*	.011, .065
Control × Value × Test 1 (%)	.00	−.022, .028	.00	−.025, .025	.02	−.009, .042
Control at low value, low Test 1 (%)	−.04	−.090, .004	−.09*	−.134, −.038	−.25*	−.302, −.203
Control at high value, low Test 1 (%)	.01	−.033, .062	−.18*	−.215, −.119	−.37*	−.419, −.321
Control at low value, high Test 1 (%)	.02	−.031, .075	−.10*	−.151, −.045	−.33*	−.387, −.279
Control at high value, high Test 1 (%)	.09*	.037, .144	−.18*	−.234, −.125	−.38*	−.440, −.329
Value at low control, low Test 1 (%)	.40*	.357, .442	−.31*	−.351, −.265	.12*	.076, .165
Value at high control, low Test 1 (%)	.46*	.404, .509	−.39*	−.443, −.336	.00	−.052, .058
Value at low control, high Test 1 (%)	.38*	.315, .440	−.32*	−.385, −.259	.16*	.100, 229
Value at high control, high Test 1 (%)	.45*	.404, .490	−.40*	−.448, −.361	.11*	.067, .157
Control × Value at low Test 1 (%)	.03	−.004, .062	−.04*	−.074, −.008	−.06*	−.094, −.025
Control × Value at high Test 1 (%)	.03	−.003, .072	−.04*	−.079, −.003	−.03	−.065, .013
R^2	.21		.18		.15	

Note. CI = confidence interval. N = 6541. Simple slopes from the Control × Value × Test 1 (%) interaction are shown for each combination of control, value, and Test 1 (%) (−1 SD = low, +1 SD = high). All predictors are z standardized with the exception of gender (0 = *female*, 1 = *male*) which was left in its original metric to facilitate interpretation. Bootstrap N = 5000.
* $p < .05$ (two−tailed tests).

Single-item Positive Outcome-emotions. For hope, the Control × Value × Test 1 (%) interaction was non-significant [β = .00, p = .843, CIs = −.023 to .019]. Two 2-way interactions, Control × Value [β = −.02, p = .042, CIs = −.044 to −.009], and Control × Test 1 (%) [β = −.03, p = .013, CIs = −.050 to −.006] were significant. The signs of the interaction effects show the positive effect of control on hope decreased as value and Test 1 (%) increased, such that the effect of control was strongest at low levels of value and Test 1 (%) [β = .31, CIs = .269 to .351], and weakest at high levels of the moderators [β = .21, CIs = .163 to .256]. Students with high control, value, and Test 1 grades were most hopeful [z = .68], students with low control, value, and achievement were least hopeful [z = −.72]. 24% of the total variance in hope was accounted for.

The pride regression model did not show a significant Control × Value × Test 1 (%) interaction [β = −.01, p = .259, CIs = −.035 to .009], but significant Control × Value [β = .03, p = .018, CIs = .005 to .050], and Control × Test 1 (%) [β = .05, p <.001, CIs = .026 to .071] interactions emerged. The signs of the interaction effects indicated that the positive effect of control on pride increased as value and Test 1 (%) increased. For students with low initial test performance, control had no effect on pride at low levels of value [β = .01, CIs = −.029 to .057], but had a positive effect on pride at high value [β = .09, CIs = .067 to .157]. The Control × Value interaction was non-significant for students with high Test 1 performance [β = .01, CIs = −.019 to .048], suggesting that the effect of control on pride was stronger at high achievement, irrespective of high [β = .16, CIs = .117 to .213] or low value [β = .14, CIs = .088 to .184]. Students with high control, value, and initial achievement reported the highest levels of pride [z = .64], whereas those with low control, value, and achievement felt least proud [z = −.50],

followed closely by students with high control, low value, and low achievement [$z = -.48$]. The regression model explained 18% of the variability in pride.

Table 3.
Regression Coefficients for Positive Single-item Achievement Emotions

Predictor variable	Hope		Pride	
	β	95% CIs	β	95% CIs
Age	.07*	.046, .089	.04*	.020, .065
Gender	.10*	.052, .142	.11*	.073, .167
Control	.26*	.239, .285	.10*	.078, .126
Value	.30*	.276, .321	.26*	.237, .285
Test 1 (%)	.14*	.119, .164	.22*	.199, .246
Control × Value	−.02*	−.044, −.001	.03*	.005, .045
Control × Test 1 (%)	−.03*	−.050, −.006	.05*	.025, .071
Value × Test 1 (%)	.02	−.006, .039	.01	−.009, .037
Control × Value × Test 1 (%)	.00	−.023, .019	−.01	−.035, .009
Control at low value, low Test 1 (%)	.31*	.269, .351	.01	−.029, .057
Control at high value, low Test 1 (%)	.27*	.228, .311	.09*	.051, .137
Control at low value, high Test 1 (%)	.26*	.213, .305	.14*	.088, .184
Control at high value, high Test 1 (%)	.21*	.163, .256	.16*	.117, .213
Value at low control, low Test 1 (%)	.30*	.265, .339	.21*	.168, .246
Value at high control, low Test 1 (%)	.26*	.215, .307	.29*	.239, .335
Value at low control, high Test 1 (%)	.34*	.286, .394	.26*	.204, .317
Value at high control, high Test 1 (%)	.29*	.253, .328	.29*	.251, .328
Control × Value at low Test 1 (%)	−.02	−.049, .008	.04*	.010, .070
Control × Value at high Test 1 (%)	−.02	−.057, .008	.02	−.019, .048
R^2		.24		.18

Note. CI = confidence interval. N = 6541. Simple slopes from the Control × Value × Test 1 (%) interaction are shown for each combination of control, value, and Test 1 (%) (−1 SD = low, +1 SD = high). All predictors are z standardized with the exception of gender (0 = *female*, 1 = *male*) which was left in its original metric to facilitate interpretation. Bootstrap N = 5000.
* $p < .05$ (two−tailed tests)

Single-item Negative Outcome-emotions. For shame, the Control × Value × Test 1 (%) interaction was significant [β = .03, p = .022, CIs = .004 to .048]. Each 2-way interaction, Control × Value [β = −.04, p = .001, CIs = −.068 to −.023], Control × Test 1 (%) [β = −.03, p = .018, CIs = −.050 to −.005], and Value × Test 1 (%) [β = .04, p = .003, CIs = .012 to .059] also reached significance. The negative direction of the Control × Value interaction shows that the negative effect of control on shame increased with value, and vice-versa. However, the 3-way interaction term indicates that the strength of the Control × Value interaction was dependent on initial test performance, such that the interaction was stronger at low initial performance [β = −.07, p < .001, CIs = −.101 to −.042] vs. high performance [β = −.02, p = .258, CIs = −.053 to .014]. For students who performed poorly on the first course test, the negative effect of control on shame was stronger at high value [β = −.29, CIs = −.332 to −.245] than at low value [β = −.15, CIs = −.189 to −.103]. Differences between the effects of value were more pronounced, such that value had a negative effect on shame at high levels of control only [β = −.14, CIs = −.185 to −.089], and had no effect on shame for students with low control [β = .01, CIs = −.033 to .044].

For students with high initial achievement, control was a strong negative predictor of shame at both low [β = −.25, CIs = −.301 to −.205] and high value [β = −.29, CIs = −.340 to −.243]. In contrast, value had no effect on shame at both low [β = .02, CIs = −.032 to .080], and high levels of control [β = −.02, CIs = −.054 to .024]. Students with low control, high value, and low Test 1 performance experienced the most shame [z = .47], followed closely by students with low scores on all [z = .46]. Students with high control, value, and achievement experienced the least shame [z = −.51]. The full regression model accounted for 18% of the variance in shame.

The model predicting anger revealed a significant Control × Value × Test 1 (%) interaction [β = .02, p = .034, CIs = .002 to .046], and a significant Control × Value interaction [β = −.03, p = .031, CIs = −.048 to −.002]. The negative direction of the Control × Value interaction effect indicates that the negative effects of control and value on anger increased at higher levels of the other appraisal. The significant 3-way interaction demonstrates that the strength of the Control × Value effect was dependent on initial test performance, whereby control and value interacted to predict anger at low levels of Test 1 achievement [β = −.05, p = .001, CIs = −.079 to −.020], but not at high achievement [β = .00, p = .956, CIs = −.035 to .033]. For students with low Test 1 grades, the negative effect of control on anger was stronger at high value [β = −.34, CIs = −.379 to −.292] vs. low value [β = −.24, CIs = −.280 to −.195]. The strength of value as a negative predictor was greater at high control [β = −.14, CIs = −.187 to −.091] vs. low control [β = −.04, CIs = −.080 to −.002].

In contrast, the negative effects of control and value on anger did not interact for students who performed well on the first course test. The effects of control did not vary between students with low [β = −.28, CIs = −.332 to −.236] vs. high value [β = −.28, CIs = −.335 to −.237], and the effects of value at low control [β = −.07, CIs = −.122 to −.009] vs. high control [β = −.07, CIs = −.106 to −.028] were equal. Students with low control, value, and initial achievement had the highest levels of anger [z = .49], whereas students with high levels on all had the lowest levels of anger [z = −.51]. The full model explained 17% of the variability in anger.

The regression model for regret showed a pattern of interaction effects aligned with the model predicting shame. The Control × Value × Test 1 (%) interaction was significant [β = .03, p = .013, CIs = .006 to .052], as were the 2-way interactions for Control × Value [β = −.06, p < .001, CIs = −.084 to −.037], Control × Test 1 (%) [β = −.05, p < .001, CIs = −.072 to −.025],

and Value × Test 1 (%) [β = .05, p < .001, CIs = .023 to .071]. The higher order 3-way interaction effect shows that the Control × Value interaction depended on students' initial test performance. For students with low Test 1 achievement, the negative effect of control on regret was dependent on value, and vice-versa [β = −.09, p < .001, CIs = −.120 to −.059]. Control had a negative effect on regret at high value [β = −.20, CIs = −.249 to −.160], but had no effect at low value [β = −.02, CIs = −.070 to .019]. Similarly, value was a negative predictor of regret at high control [β = −.21, CIs = −.260 to −.161], and had no effect at low control [β = −.03, CIs = −.071 to .008].

In contrast, for students with high initial achievement, control and value did not interact to predict regret [β = −.03, p = .071, CIs = −.067 to .003]. The difference between the negative effects of control at high value [β = −.24, CIs = −.294 to −.160] vs. low value [β = −.18, CIs = −.229 to −.131] did not reach statistical significance. Value was a negative predictor of regret at high control [β = −.06, CIs = −.098 to −.019], and had no effect at low control [β = .01, CIs = −.052 to .063], but the difference between these effects did not reach statistical significance. Students with low control, value, and initial achievement felt the most regret [z = .37], whereas students with high levels on all were least regretful [z = −.45]. The full model accounted for 13% of the variance in regret.

For helplessness, the Control × Value × Test 1 (%) interaction was non-significant [β = .01, p = .333, CIs = −.011 to .031]. The Control × Value [β = −.03, p = .009, CIs = −.050 to −.007], and Control × Test 1 (%) [β = .03, p < .001, CIs = −.072 to −.025] interaction effects were significant. The negative direction of the Control × Value interaction indicates that the negative effect of control on helplessness increased with value, and vice-versa. The positive sign of the Control × Test 1 (%) interaction shows that the negative effect of control on helplessness decreased as Test 1 achievement increased. Although the higher-order 3-way interaction did not

reach statistical significance, the Control × Value interaction was significant at low levels of Test 1 (%) [β = −.04, p = .006, CIs = −.067 to −.011], but not at high Test 1 achievement [β = −.02, p = .258, CIs = −.050 to .014]. For students with poor initial test performance, the negative effect of control on helplessness was stronger at high value [β = −.49, CIs = −.536 to −.453] vs. low value [β = −.42, CIs = −.456 to −.375]. Differences between the effects of value were more pronounced, such that value had a negative effect on helplessness at high levels of control only [β = −.08, CIs = −.128 to −.037], but had no effect on helplessness for students with low control [β = .00, CIs = −.041 to .033].

For students who performed well on the initial course test, the negative effect of control on helplessness was not significantly different between students with low [β = −.38, CIs = −.430 to −.339] and high value [β = −.42, CIs = −.470 to −.375]. Value had no effect on helplessness at low [β = .01, CIs = −.043 to .064] or high levels of control [β = −.03, CIs = −.063 to .010]. Students with low control and Test 1 grades felt most helpless regardless of having high [z = .60] or low value [z = .60]. Students with high control, value, and achievement felt least helpless [z = −.58]. 26% of the total variance in helplessness was accounted for in the full regression model.[1]

[1]A post-hoc power analysis based on the smallest observed significant effect (R^2 increase = .002), the given sample size (N = 6541), and α set at .05 revealed a statistical power level of 95.1%.

Table 4.

Regression Coefficients for Negative Single-item Achievement Emotions

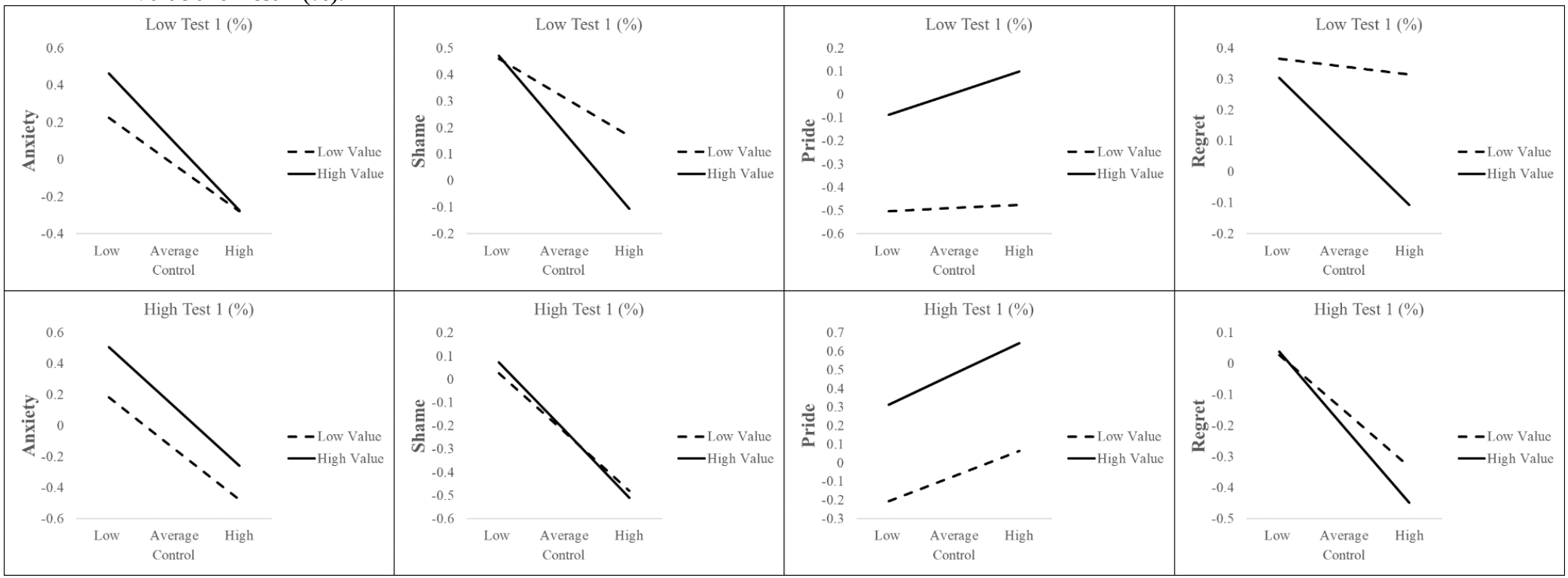
Predictor variable	Shame		Anger		Regret		Helplessness	
	β	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs
Age	−.03*	−.053, −.009	−.04*	−.059, −.014	−.03*	−.052, −.006	−.02	−.039, .003
Gender	.02	−.022, .071	.05*	.008, .102	.01	−.037, .059	−.05*	−.098, −.100
Control	−.24*	−.268, −.221	−.29*	−.310, −.262	−.16*	−.188, −.139	−.43*	−.451, −.406
Value	−.03*	−.055, −.007	−.08*	−.102, −.054	−.07*	−.098, −.049	−.03*	−.048, −.003
Test 1 (%)	−.24*	−.259, −.212	−.17*	−.189, −.142	−.20*	−.223, −.174	−.15*	−.172, −.123
Control × Value	−.04*	−.068, −.023	−.03*	−.048, −.002	−.06*	−.084, −.037	−.03*	−.050, −.007
Control × Test 1 (%)	−.03*	−.050, −.005	.00	−.022, .024	−.05*	−.072, −.025	.03*	.005, .048
Value × Test 1 (%)	.04*	.012, .059	.01	−.017, .035	.05*	.023, .071	.02	−.005, .040
Control × Value × Test 1 (%)	.03*	.004, .048	.02*	.002, .046	.03*	.006, .052	.01	−.011, .031
Control at low value, low Test 1 (%)	−.15*	−.189, −.103	−.24*	−.280, −.195	−.02	−.070, .019	−.42*	−.456, −.375
Control at high value, low Test 1	−.29*	−.331, −.245	−.34*	−.379, −.292	−.20*	−.249, −.160	−.49*	−.534, −.453
Control at low value, high Test 1	−.25*	−.301, −.205	−.28*	−.332, −.236	−.18*	−.229, −.131	−.38*	−.430, −.339
Control at high value, high Test 1	−.29*	−.340, −.243	−.28*	−.335, −.237	−.24*	−.294, −.194	−.42*	−.467, −.375
Value at low control, low Test 1 (%)	.01	−.033, .044	−.04*	−.078, −.002	−.03	−.071, .008	.00	−.041, .033
Value at high control, low Test 1	−.14*	−.185, −.089	−.14*	−.187, −.091	−.21*	−.260, −.161	−.08*	−.128, −.037
Value at low control, high Test 1	.02	−.032, −.080	−.07*	−.122, −.009	.01	−.052, .063	.01	−.043, .064
Value at high control, high Test 1	−.02	−.054, .024	−.07*	−.106, −.028	−.06*	−.098, −.019	−.03	−.063, .010
Control × Value at low Test 1 (%)	−.07*	−.101, −.042	−.05*	−.079, −.020	−.09*	−.120, −.059	−.04*	−.067, −.011
Control × Value at high Test 1 (%)	−.02	−.053, .014	.00	−.035, .033	−.03	−.067, .003	−.02	−.050, .014
R^2		.18		.17		.13		.26

Note. CI = confidence interval. N = 6541. Simple slopes from the Control × Value × Test 1 (%) interaction are shown for each combination of control, value, and Test 1 (%) (−1 SD = low, +1 SD = high). All predictors are *z* standardized with the exception of gender (0 = *female*, 1 = *male*) which was left in its original metric to facilitate interpretation. Bootstrap N = 5000.

* $p < .05$ (two−tailed tests).

Figure 1

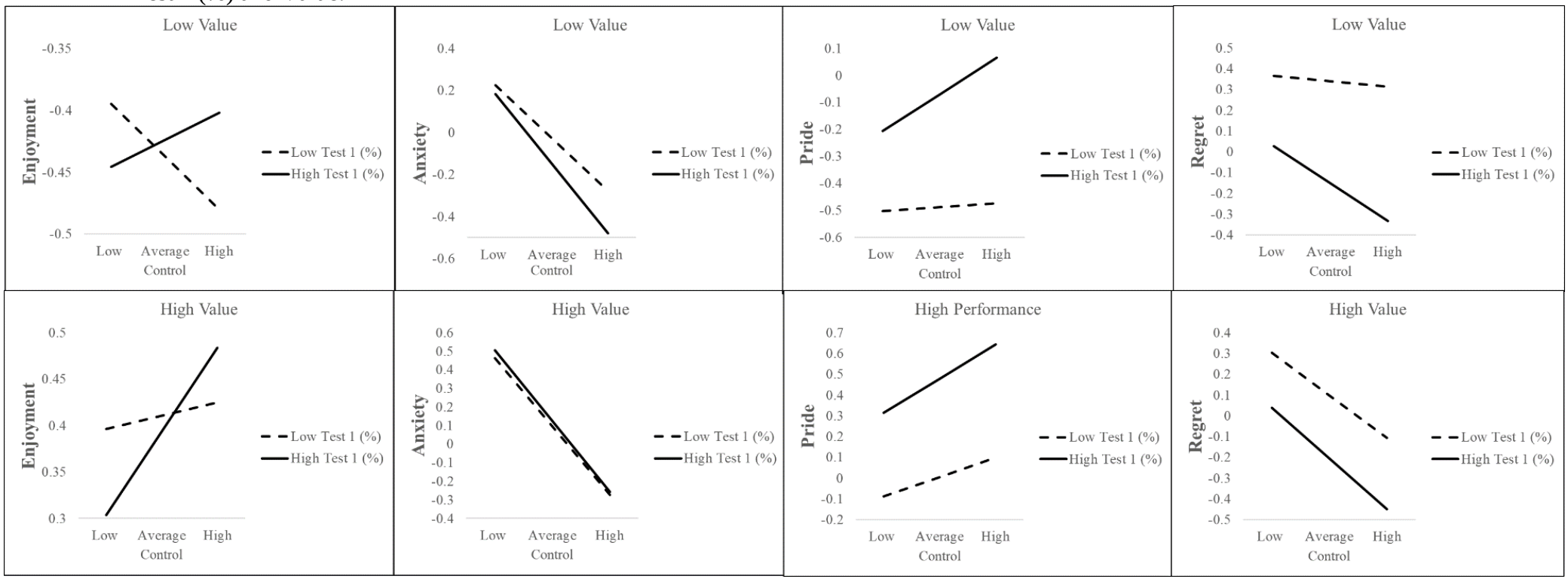
Simple Effects (slopes) of Control on Select Achievement Emotions at each Combination of High (+1 SD) and Low (−1 SD) levels of Value and Test 1 (%).



Note. N = 6451. Cohort, age, and sex were included as covariates.

Figure 2

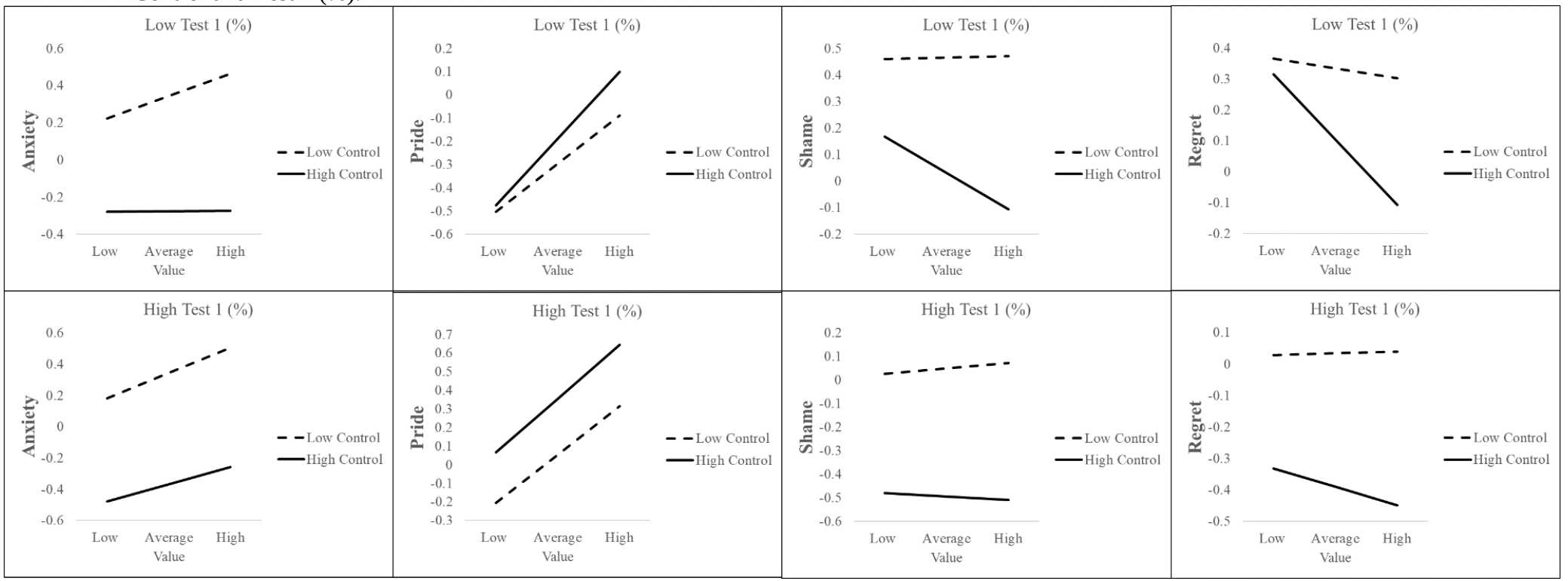
Simple Effects (slopes) of Control on Select Achievement Emotions at each Combination of High (+1 SD) and Low (−1 SD) Levels of Test 1 (%) and Value.



Note. N = 6451. Cohort, age, and sex were included as covariates.

Figure 3

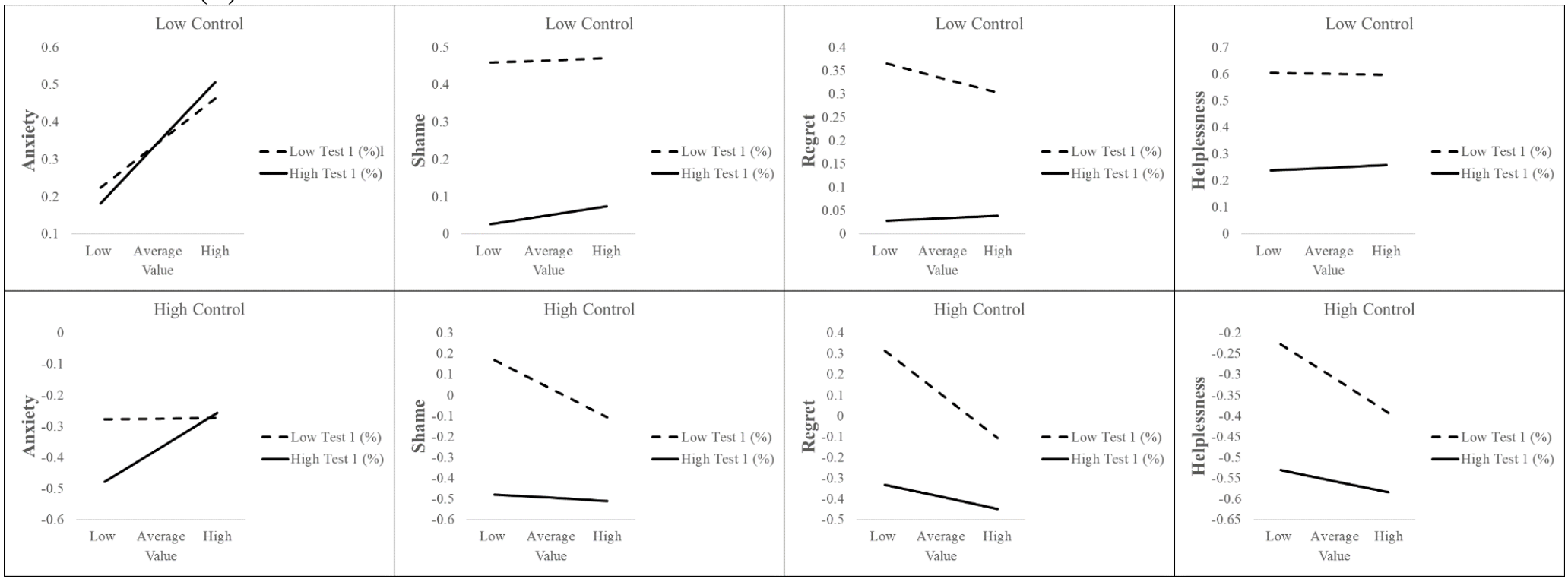
Simple Effects (slopes) of Value on Select Achievement Emotions at each Combination of High (+1 SD) and Low (−1 SD) levels of Control and Test 1 (%).



Note. N = 6451. Cohort, age, and sex were included as covariates.

Figure 4

Simple Effects (slopes) of Value on Select Achievement Emotions at each Combination of High (+1 SD) and Low (−1 SD) Levels of Test 1 (%) and Control.



Note. N = 6451. Cohort, age, and sex were included as covariates.

Discussion

Atheoretical research is common in social psychology (McPhetres et al., 2021), and carries a high risk of false-positives and unverifiable explanations of phenomena (Stroebe, 2016). Past theory-testing research is often neglected as bygone social psychology theories are discarded and replaced rather than integrated with contemporary theoretical frameworks, resulting in failures to progress cumulative scientific knowledge (Elliot et al., 2023; Muthukrishna & Henrich, 2019).

Explicit tests of theory-derived propositions conducted with rigorous methodological practices must be paired with efforts towards theory integration to bolster the scientific fidelity in social psychological research. This study combined perspectives from Pekrun's (2006; 2018) control-value theory of achievement emotions and Weiner's (1985, 2014, 2018) attribution theory to replicate and extend knowledge of the multiplicative effects of academic control and value on achievement emotions. Consistent with CVT, interactive effects between control and value emerged for all discrete emotions. Consistent with attribution theory, interactions for certain emotions depended on students' initial achievement outcomes, suggesting that an adaptive mindset is crucial for emotional resilience following perceived academic setbacks.

Synergistic Effects of Control, Value and Test 1 Performance on Emotion

Activity-emotions. The Control × Value interaction effect successfully replicated in models predicting enjoyment and boredom (Putwain et al., 2018; Shao et al., 2020). The positive effect of control on enjoyment increased with value, such that it was a significant predictor of enjoyment at high, but not low, value. Value was a strong positive predictor of enjoyment, with more pronounced effects at high levels of control. Boredom showed a similar pattern. Value had

a stronger negative effect on boredom than control, and the negative effects of control and value increased in magnitude with levels of the other respective appraisal.

Critically, students' Test 1 (%) achievement did predict their feelings of boredom and enjoyment, and did not moderate the strength of the Control × Value interaction. This supports CVTs distinction between activity- and outcome-emotions. Despite poor performance on an important initial achievement outcome, students with high control and value experienced greater enjoyment and less boredom than high-performing students with low perceived control and value. However, a positive interaction between control and Test 1 performance emerged, suggesting that the effects of control on enjoyment were stronger for high-achieving students. Given that high control cultivates expectations for high achievement, failure to meet these expectations may compromise the enjoyment that may come from striving for control through academic engagement.

Positive Outcome-emotions. Control and value interacted to predict feelings of hope and pride. For pride, the positive interaction effect was successfully replicated (Goetz et al., 2010; Bieg et al., 2013; Shao et al., 2020). A positive 2-way interaction was found between control and initial test performance indicating that the positive effect of control on pride increased with achievement. This is consistent with attribution theory, which posits that internal attributions for academic success (i.e., high effort, high ability) trigger feelings of pride. Within CVT, patterns of internal attributions for success outcomes foster appraisals of academic control.

In contrast to past findings, the Control × Value interaction effect for hope was negative, suggesting that the positive effect of control on hope decreased with increasing value, and vice-versa. However, this is the first study focused on interactions between control and value to examine initial achievement as an additional moderator; the model for hope showed a significant

negative interaction effect between control and Test 1 (%). This indicates that the effect of control on hope became weaker at higher levels of achievement. Within CVT and attribution theory, feelings of hope reflect positive but uncertain expectations of future success. CVT further specifies that when appraisals of control over success are very high, hope is obviated by enjoyment in anticipated success (Pekrun, 2006). It is consistent with theory that high achievement may attenuate the relationship between control and hope, as students become more certain about future academic successes.

Negative Outcome-emotions. Negative interaction effects between control and value were successfully replicated for anxiety, shame, anger, regret, and helplessness (Shao et al., 2020). Significant 3-way Control × Value × Test 1 (%) interactions emerged in models predicting shame, anger, and regret. For each negative outcome-emotion, the Control × Value interaction effect was significant at low, but not high, levels of initial test performance. This indicates that the interactive effects between control and value on negative outcome-emotions depend on students' achievement outcomes.

For anxiety, differences between the effects of value at low vs. high levels of control and Test 1 (%) were substantial. Value had a positive effect on anxiety except when combined with high control appraisals and low Test 1 achievement. The model revealed a positive interaction effect between value and Test 1 (%), indicating that the positive effect of value on anxiety increased with achievement. In keeping with CVT, students who highly valued achievement but perceived a lack of control experienced strong feelings of anxiety; those with high achievement and value, but low control, had the highest levels of anxiety (see Figure 7). Academic control appears to be the critical factor for maintaining adaptive levels of achievement-related anxiety.

Contrary to predictions, anxiety was the only outcome-emotion not significantly predicted by initial test performance.

For shame, Control × Value and Control × Test 1 (%) interactions were negative, and the Value × Test 1 (%) interaction was positive. The negative effect of control on shame increased with value and initial achievement. The negative effect of value on shame increased with control but was attenuated by high achievement, such that value was a significant negative predictor of shame only when combined with high academic control and low initial test performance. Consistent with attribution theory, the significant 3-way interaction showed that appraisals of control and value are crucial for emotional resilience following academic failure. Students who received a letter-grade of D or F on the first course test experienced strong feelings of shame when combined with low levels of control and value. In contrast, low-achieving students with high control and value reported below-average levels of shame. In accordance with CVT, students who highly valued achievement but perceived a lack of control after an achievement setback had the highest levels of shame.

The model predicting anger showed a negative interaction between control and value qualified by a Control × Value × Test 1 (%) interaction. The negative effect of control on anger increased with value, and vice-versa, but only at low levels of Test 1 achievement. Following poor initial test performance, students with low levels of control and value experienced the strongest feelings of anger, whereas those with high control and value felt low anger.

Antecedents of course-related regret followed a pattern similar to shame. The interactive effects between control and value, along with the interaction between control and initial achievement were negative, whereas the interaction between value and Test 1 (%) was positive. The strength of the Control × Value interaction was further moderated by Test 1 performance.

For low-achieving students, differences between the effects of control and value at low (vs. high) levels of the other respective appraisal were striking. At low levels of value, control had no effect on regret, but had a negative effect at high value. Similarly, value did not predict regret at low control, but predicted lower levels of regret at high control. Students with low levels of control and value had the highest levels of regret following an achievement setback, whereas students with high control and value did not experience strong course-related regret despite initial failure.

The model predicting helplessness revealed a negative Control × Value interaction and a positive Control × Test 1 (%) interaction. The 3-way interaction did not reach significance, but the Control × Value interaction was found to be significant at low, but not high, levels of initial achievement. The potential moderating influence of Test 1 performance on the Control × Value interaction is exemplified by the effect of value, which was negative only when combined with high control and low performance. The positive interaction between Control and Test 1 (%) indicates that the effect of control was attenuated by high initial achievement. This suggests that high-achieving students may be protected to some extent from feelings of helplessness despite a perceived lack of control. However, academic control was a strong negative predictor of helplessness across all levels of value and performance, and students with high performance and low control still reported above-average levels of helplessness. Consistent with other negative outcome-emotions, control and value appear crucial for maintaining adaptive levels of helplessness following an initial academic setback. Students who performed poorly and perceived a lack of control and value felt most helpless, whereas those with high control and value had relatively low feelings of helplessness.

Strengths, Limitations, Future directions

Several noteworthy strengths characterize the current study. First, interactive effects between control and value were successfully replicated for every achievement emotion. This adds support to a critical assumption within CVT. Second, the limitations of prior research focused on appraisal interactions were corrected (Bieg et al., 2013; Goetz et al., 2010; Putwain et al., 2018). This study broadened focus to a wide range of discrete emotions, and highlighted the moderating role of academic control on value in addition to the moderating role of value on control.

Third, this was the first study to examine how an important initial achievement outcome may moderate the synergistic effects of control and value on emotions. Finally, following calls for theory-testing and theory integration in social psychology (Elliot et al., 2023; McPhetres et al., 2021; Muthukrishna & Henrich, 2019), this study combined perspectives from Pekrun's (2006; 2018) control-value theory of achievement emotions and Weiner's (1985, 2014, 2018) attribution theory. Consistent with attribution theory, an optimal mindset denoted by high appraisals of academic control and value appear crucial for maintaining adaptive achievement emotions following a negative, unexpected, and important achievement outcome (i.e., test failure). In keeping with CVT and attribution theory, academic control, value, and achievement accounted for a substantial amount of variance in students' emotions.

Concerning limitations, this study used an undifferentiated measure of perceived value. CVT specifies a distinction between appraisals of intrinsic and extrinsic value. It is possible that the moderating role of value on the effects of academic control predicting achievement emotions differs according to the intrinsic/extrinsic distinction. Further, the majority of emotions examined in this study were assessed through single-item measures, which carry psychometric drawbacks relative to established, multiple-item scales (Kline, 2010). This can be regarded as an additional

methodological limitation. Psychometrically validated scales such as those found in Pekrun et al.'s (2011; 2023) AEQ not available in The MAACH archival database. It was not possible to use multiple-item emotion scales beyond those assessing enjoyment, boredom, and anxiety. However, use of single-item measures is established practice in emotion research, and is a valid method for examining individuals' subjective experience in achievement contexts (Ainley & Patrick, 2006; Daniels et al., 2009; Gogol et al., 2014).

This study provides several avenues for future research. Control × Achievement, Value × Achievement, and 3-way interactions between appraisals and achievement are novel findings. As such, these effects require replication in diverse samples and achievement settings. This study's sample consisted of newly enrolled students undergoing a school-to-college transition. The transition to college is fraught with novel challenges including unfamiliar learning tasks and environments, increased personal responsibility, unstable social networks, difficult career choices, financial debt, and frequent academic failure (Perry et al., 2001, 2005, 2014). These conditions may exacerbate the threat of academic failure and the severity of negative emotions following perceived setbacks. This, in turn, may have contributed to the interactive effects of achievement and appraisals in the current study. Replicating these interaction effects in primary and secondary school students, as well as senior-level undergraduates would contribute substantially to theory verification and integration.

Extending this study's methodology would bolster the current findings. Future studies could incorporate longitudinal designs to determine if interactions between control, value, and achievement are stable predictors of achievement emotions beyond the effects of prior appraisals, emotions, and performance. A latent-variable analytic approach using established multiple-item scales for each emotion would provide more accurate estimates of the magnitude

and direction of interaction effects. Finally, including causal attributions as mediators of achievement-control relationships in moderated-mediation models would support theory integration through a more explicit connection between salient constructs from CVT and attribution theory.

Conclusion

There remains a paucity of research focused on verifying a fundamental assumption of CVT, namely that control and value exert synergistic effects on emotions beyond their additive independent effects. In keeping with CVT, control and value interacted to predict nine discrete achievement emotions. This is the first study aimed at integrating attribution theory with CVT by examining if Control × Value interactions are further moderated by students' initial achievement outcomes. Consistent with CVT, Test 1 performance did not predict activity-emotions or influence the strength of interactive effects between control and value. In accordance with attribution theory, a negative, unexpected, and important achievement outcome moderated the effect of Control × Value interactions on negative outcome-emotions, indicating that an adaptive mindset is crucial for students' emotional resilience following academic failure.

These conclusions support the demonstrated efficacy of theory-based attributional retraining interventions for boosting academic control, objective achievement, and fostering adaptive levels of achievement emotions (Perry & Hamm, 2017). Attributional retraining provides the greatest benefits to students characterized by academic risk factors, including those with low perceived control (Dryden et al., 2021; Parker et al., 2018), and students who perform poorly on an initial course test (Perry et al., 2010). Attributional retraining is a brief, online, scalable motivation intervention that can be implemented in academic programs at relatively low cost.

Future studies assessing the efficacy of attribution-based treatment interventions may benefit from incorporating perceptions of academic value as either a moderator of treatment efficacy, a theory-relevant outcome variable, a moderator of post-treatment PAC with emotion outcomes, or some combination thereof. As a moderator, in conjunction with the conditional influence of pre-treatment PAC (low vs. high), students' levels of pre-treatment value may enhance or diminish the salutary effects of AR treatment. It is possible that students with high value and low PAC may benefit most from AR remediation, to the extent that boosts in PAC are further augmented by high value appraisals. Conversely, AR may demonstrate the greatest efficacy for students with low perceptions of both academic control and value, to the extent that students with these characteristics represent the greatest need for motivational interventions.

As an outcome variable, AR may also enhance value appraisals directly. Adaptive causal attributions for setbacks may increase the positive perceptions of future success, or positive experiences during engagement in course-related achievement behaviors, in tandem with increased PAC. Aligned with the results of the current study, future AR studies may also examine post-treatment value as a moderator of post-treatment PAC. This study, and others focused on Control × Value interactions, demonstrate the importance of both high control and value appraisals for maximizing students' individual patterns of discrete achievement emotions. As such, boosts in PAC may be diminished for students with low levels of post-treatment value, and enhanced for students with high value appraisals. For interventions focused on enhancing value appraisals (e.g., Canning et al., 2018; Rosenzweig et al., 2019), incorporating PAC appraisals as either a moderator of treatment, outcomes, or moderator of post-treatment value would similarly help clarify methods for maximizing treatment efficacy for struggling students.

Research focused on theory-testing and theory integration must serve as the foundation for developing a comprehensive understanding of psychosocial cognitive, affective, and motivation processes. Shifting focus from atheoretical ad hoc explanations of phenomena towards integrated theory-based frameworks is a necessary step for improving social psychology's contributions to cumulative scientific knowledge (Stroebe, 2016). This study represents a significant contribution toward that goal.

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CHAPTER 3

Study 2

Control and Value Appraisals Mediate Relationships between Achievement Goals and Emotions

Life course transitions such as moving to another city, starting a new career, marriage, and age-onset disabilities involve diverse motivation challenges and setbacks (Chipperfield et al., 2003; 2019; Hamm et al., 2019; Heckhausen et al., 2019). The K-16 education system entails challenging transitions into novel learning environments for young adults, high school-to-college transitions being particularly salient. Over 25% of American college students do not reach their second year of studies, and fewer than 60% attain their degree within eight years (Aina et al., 2022). Almost 90% of American college students have felt overwhelmed by their studies, 56% have experienced hopelessness, 66% have felt excessive anxiety, and 28% of students reported anxiety as negatively impacting their academic achievement (American College Health Association, 2019).

Curbing these states of emotional distress rests on further advances, empirical validation, and practical application of socio-cognitive theories, such as Pekrun's (2006, 2018) control-value theory of achievement emotions (CVT). Motivation interventions developed within the framework of CVT demonstrate efficacy for improving students' emotional well-being and achievement outcomes (Tze et al., 2022). However, these interventions rarely target important motivation factors beyond control and value appraisals such as students' achievement goals (Cromley et al., 2020; Rosenzweig et al., 2022).

CVT provides a comprehensive framework regarding determinants of achievement emotions, few studies have incorporated CVT's perspective on what are assumed to be distal

antecedents of emotions such as achievement goals. This study fills a knowledge gap in the CVT literature by examining whether appraisals of perceived control and value mediate relationships between achievement goals and emotions. This critical CVT assumption regarding antecedent cognitive processes has yet to be empirically tested in a longitudinal framework (Linnenbrink-Garcia & Barger, 2014; Pekrun et al., 2009).

Transitions to Competitive Learning Environments

Specific learning environments can strongly influence an individual's motivation (Urdan & Schoenfelder, 2006). Individuals encounter critical transitions throughout their academic development that provide windows of opportunity to pursue and achieve consequential goals (Heckhausen et al. 2010). However, the multitude of unfamiliar challenges associated with novel environments and responsibilities are commonly experienced as overwhelming, which can lead to detrimental effects on students' motivation (Perry, 2003). The many obstacles to success encountered during school-college shifts include unfamiliar learning conditions, increased academic competition, greater emphasis on autonomy and personal responsibility, debt, unstable social networks, and critical career choices (Perry, 2003; Perry, Hall, & Ruthig, 2005; Perry et al., 2014).

Within this context, otherwise trait-like psychosocial factors are sensitive to environmental cues during this period of uncertainty, and thus more labile to change across the first academic year. Students' perceptions of academic control, for example, often decrease in the initial months of adjustment to novel competitive learning environments (Muis et al., 2013; Respondek et al., 2017; 2020). However, students begin the school-college transition with clear goals, which remain largely stable over time (Heckhausen et al., 2013; Yau et al., 2021). The period of transition to a competitive learning environment is thus an ideal setting to examine the

influence of achievement goals on appraisals and emotions over time. Logically, students must be committed to pursuing an achievement goal when they enroll in a course (Hamm et al., 2013). However, stable appraisals of control and value develop only after engaging with course content, and receiving achievement feedback that either conforms to or defies their expectations (Parker et al., 2021).

Appraisals and Emotions

A fundamental proposition of CVT is that socio-cognitive appraisals of control and value have a proximal influence on the arousal of achievement emotions. The theory states that achievement emotions are induced when an individual perceives they have (or lack) control over activities and outcomes that are subjectively important. Perceived (agentic) control refers to the subjective appraisal of one's ability to influence and predict important events, actions, and life outcomes across the lifespan (Heckhausen et al., 2010; Morling & Evered, 2006; Perry, 1991, 2003; Skinner, 1996).

In achievement settings, researchers have focused on the widely used, domain-specific construct of perceived academic control (PAC). The PAC scale, first proposed by Perry and colleagues (Perry et al., 2001; Perry, Hladkyj et al., 2005) has been subsequently investigated across different cultural contexts. Low PAC students prematurely withdraw from courses, receive poor grades, and experience emotional distress (Respondek et al., 2017; Ruthig et al., 2009; Stupnisky et al., 2013). Within CVT, PAC is proposed to instigate positive emotions and prevent negative emotions by cultivating expectations and experiences of success and competence (Pekrun & Perry, 2014; Perry, 2003; Perry & Hamm, 2017).

Meta-analytic studies show that control-related constructs are the strongest psychosocial predictors of college GPA (e.g., Richardson et al., 2012; Robbins et al., 2004; Schneider &

Preckel, 2017). The literature largely supports hypothesized relationships between the PAC scale and learning-related emotions (Bieg et al., 2013; Forsblom et al., 2022; Parker, Perry, Chipperfield et al., 2018; Pekrun et al., 2023; Perry et al., 2014; Ruthig et al., 2008; Tze et al., 2021). Further, randomized-treatment field studies indicate that cognitive-reframing motivation interventions indirectly promote adaptive emotions by enhancing PAC (Dryden et al., 2023; Hamm et al., 2017; Parker, Perry, Hamm et al., 2018).

CVT posits that value generally amplifies both positive and negative achievement emotions (Pekrun, 2006, 2018, 2021). The theory states that individuals who appraise achievement activities and outcomes as highly important (valuable) will have stronger emotional experiences during learning activities and following success and failure outcomes. Thus, individuals who devalue their achievement (i.e., appraised as unimportant) will generally have weaker emotional experiences, with the exception of one emotional experience, boredom. Boredom is induced when achievement activities are perceived as having little or no value (Pekrun & Perry, 2014). Studies generally show associations between value and emotions aligned with CVT (Goetz et al., 2020; Noteborn et al., 2012; Parker et al., 2021; Pekrun et al., 2010; Putwain et al., 2018; see Pekrun et al., 2023, and Pekrun & Perry, 2014 for reviews).

Achievement Goals and Emotions

Achievement goals refer to “self-regulatory commitments that provide direction to individuals as they interpret and respond to competence-relevant situations” (Sommet & Elliot, 2016, p. 1). Salient categories of achievement goals include mastery-approach and performance-approach goals. Students with mastery-approach goals hold task-related and intra-individual standards for learning and performance; they attempt to learn as much as possible, using their own growth in learning as a competence-based benchmark. In contrast, students with

performance-approach goals hold inter-individual standards for performance; they seek to perform well relative to other students, using their normative performance relative to peers as a competence-based criterion (Elliot, 1999; Elliot & McGregor, 2001; Elliot & Murayama, 2008).

Mastery-approach goals generally show salutary associations with positive achievement emotions such as enjoyment, hope, and pride (Daniels et al., 2008, 2009; Guo et al., 2022; Harackiewicz et al., 2002; King et al., 2012; Pekrun et al., 2006, 2009). These goals show small negative or non-significant relationships with anxiety, and shame (Bandalos et al., 2003; Daniels et al., 2008, 2009; Huang, 2011; Pekrun et al., 2006, 2009; Putwain & Symes, 2012).

Performance-approach goals typically show non-significant relationships with activity emotions such as enjoyment and boredom (Daniels et al., 2009; Hall et al., 2016; Pekrun et al., 2006, 2009; Shih, 2008). There is no clear pattern of association between performance-approach goals and negative emotions tied to academic outcomes (e.g., anxiety, shame). Inconsistent findings have emerged across studies, demonstrating associations that are positive (Bandalos et al., 2003; Daniels et al., 2008, 2009; King et al., 2012), negative (Duchesne & Ratelle, 2010; Shih, 2005), or non-significant (e.g., Pekrun et al., 2006, 2009; Putwain & Symes, 2012; Shih, 2008).

From the perspective of CVT, mastery- and performance-approach goals influence achievement emotions indirectly by shaping control and value appraisals. Mastery-approach goals are posited to support perceptions of control and value by encouraging students' focus on mastery of activities and their positive value. Performance-approach goals are assumed to focus appraisals on the controllability and positive value of achieving normative success relative to peers (Pekrun et al., 2006; 2009).

Research on how achievement goals predict control and value appraisals is sparse. Generally, studies show positive bivariate associations between mastery- and performance-approach goals with appraisal-related constructs (i.e., self-efficacy, task instrumentality; Friedel et al., 2007; Greene et al., 2004; Hulleman et al., 2008; Plante et al., 2013). However, the majority of extant studies did not use longitudinal models (O'Keefe et al., 2022).

In accordance with CVT, Daniels et al. (2014) found that PAC mediated relationships between mastery- and performance-approach goals and GPA, but the authors did not include emotions in their models. To date, only Hall et al. (2016) empirically tested CVT's proposed goal-appraisal-emotion mediation process, but used a cross-sectional design which limits the appropriateness of assessing mediation (Maxwell et al., 2011; O'Laughlin et al., 2018).

Study Hypotheses

This study extends Pekrun et al.'s (2006, 2009) reasoning governing relationships between achievement goals, appraisals of control and value, and learning-related emotions. Further, I tested the associations between emotions and objective performance on a subsequent test in the two-semester course, as CVT specifies emotions as important factors influencing performance outcomes (Pekrun, 2006). I focused on three learning-related emotions salient in achievement settings and in the CVT literature: enjoyment, boredom, and anxiety. Based on CVT (e.g., Pekrun, 2006; Pekrun et al., 2009), hypotheses were as follows:

H1: Mastery- and performance-approach goals positively predict PAC and value

H2: PAC has adaptive associations with enjoyment, boredom, and anxiety in achievement settings. Value shows similar associations, but positively predicts anxiety.

H3: PAC and value appraisals are mediators in the relations between mastery- and performance-approach goals and achievement emotions.

H4: Learning-related enjoyment positively predicts test grades; boredom and anxiety negatively predict test grades.

Method

Participants

This multiple-cohort longitudinal field study comprised students from a two-semester, online introductory psychology course at a research-intensive university in western Canada (N = 3361). Three separate cohorts of introductory psychology students from 2016-18 participated. The majority of students were female (60.7%), in their first year of university (68.8%), and spoke English as their first language (76.4%). All participants received a final grade in the course, completed an omnibus questionnaire in Semester 1 and received a follow-up questionnaire in Semester 2.

Some students who completed the Semester 1 questionnaire did not complete the Semester 2 questionnaire (N = 3361 vs. 2664; 20.7% attrition). I performed Little's missing completely at random (MCAR) test for missing data (Little, 1988), followed by a series of t-tests on differences between students with complete versus incomplete data. Little's test was statistically significant ($p < .001$), indicating a lack of MCAR. Follow-up t-tests revealed that students who completed the Semester 2 omnibus questionnaire (vs. non-responders) represented a higher proportion of females, had higher performance-approach goals, and higher high school grades at baseline.

To the extent that baseline variables could account for missing data, I included them as covariates for all outcomes, treated data as missing at random (MAR), and adjusted for missing data using full information maximum likelihood (FIML) estimation (Jeličić et al., 2009; Nicholson et al., 2017).

Procedure

Data collection occurred in Semesters 1 and 2 for each year between 2016-17 to 2018-19. In Semester 1 (October), students completed an academic questionnaire over a secure online portal approximately one month into a two-semester introductory psychology course. Achievement goals, first language, sex, and high school grades were assessed in the Semester 1 questionnaire.

In Semester 2 (March), students completed a follow-up questionnaire that contained appraisal and emotion measures using the same online portal. Test 6 achievement data were obtained from objective institutional records following completion of the course (May). Students provided informed consent for their questionnaire and achievement data to be used for research purposes.

This study used data from a larger 25-year project on student motivation and academic achievement (MAACH; see Hamm et al., 2020; Perry et al., 2008; Perry, Hladkyj et al., 2005; Perry, 2003). This precluded an examination of avoidance goals, because they were not available in The MAACH archival database. The project was approved by the institution's Psychology and Sociology Research Ethics Board.

Achievement Goals (Semester 1, October)

Mastery- and Performance-Approach Goals. A six-item course-specific goals scale adapted from the Achievement Goal Questionnaire-Revised (AGQ-R; Elliot & Murayama, 2008) assessed students' mastery-approach goals (3 items; e.g., "My goal is to learn as much as possible") and performance-approach goals (3 items; e.g., "My goal is to perform better than the other students"; 1 = *strongly disagree*, 5 = *strongly agree;* see Table 1 for descriptive statistics). The mastery and performance-approach goal subscales had good psychometric reliability

(Cronbach's αs =.80; .81, respectively), consistent with past research (Cronbach's α range = .76 – .89, Haynes et al., 2008; Pekrun et al., 2006, 2009; see Appendices G-H).

Perceived Academic Control and Value Appraisals (Semester 2, March).

Perceived Academic Control (PAC). A course-specific, eight-item PAC scale developed by Perry and colleagues (Perry, 1991; Perry et al., 2001; Perry, Hladkyj et al., 2005) assessed students' personal (agentic) control of their achievement (e.g., "I have a great deal of control over my academic performance in my psychology course;"). Four items were negatively worded and reverse coded (e.g., "There is little I can do about my performance in introductory psychology"). The scale had good psychometric reliability (Cronbach's α = .83), in keeping with previous research (Cronbach's α range = .75 – .81; Haynes et al., 2006; Pekrun et al., 2010; Perry et al., 2001, 2010; Ruthig et al., 2009; see Appendix A).

Academic Value. A six-item course-specific scale adapted from Pekrun and Meier's (2011) academic value scale ("In general, learning about the issues raised in this course is useful"; 1 = *strongly disagree*, 5 = *strongly agree*) assessed students' appraisal of the course's importance. The scale had good reliability (Cronbach's α = .88) in accordance with prior studies (Dietrich et al., 2015; Parker et al., 2021; Tze et al., 2021; see Appendix B).

Achievement Emotions

Enjoyment, Boredom, and Anxiety (Semester 2, March). Course-specific versions of Pekrun et al.'s (2011) Achievement Emotions Questionnaire (AEQ) assessed three emotions (1 = *strongly disagree*, 5 = *strongly agree)*: enjoyment ("I enjoy doing my assignments"); boredom ("This course bores me to death"); anxiety ("I worry my assignments might be too difficult"). Each scale comprised five items and had good reliability (α range = .78 – .88;), consistent with

the AEQ literature (Buhr et al., 2019; Frenzel et al., 2007; Pekrun et al., 2011, see Appendices C-E).

Achievement (Semester 2, April)

Test 6 (%). Students completed the sixth and final in-class introductory psychology test approximately one-month after completing the Semester 2 questionnaire and 7 months into the two-semester course (April). Test 6 was a multiple-choice exam covering topics from three unique chapters of an introductory psychology textbook and accompanying class lectures. Test 6 percent scores were obtained from the course instructor at the end of the two-semester course.

Covariates

Demographics. Students indicated their sex (0 = *female*, 1 = *male*), and first language (0 = *English*, 1 = *non-English*) through single-item self report measures.

High School Grade (Semester 1). Students provided their average high school grade (percentage) on a 10-point scale (1 = *50% or less*, 10 = *91-100%*,). Self-reported high school grade measures show a high degree of association with objective high school achievement (r = .84, Perry, Hladkyj et al., 2005; r = .84, Hall et al., 2007). Studies suggest high school grades are better predictors of post-secondary achievement than standardized entrance exams (e.g., SAT or ACT; Galla et al., 2019; Schneider & Preckel, 2017; Sticca et al., 2017).

Cohort. Student cohorts (2016-17, 2017-18, 2018-19) were coded using 2 dummy variables.

Results

Rationale for Analyses

A confirmatory factor analysis (CFA) measurement model was used to test the relationship between item scores and latent factors (Kline, 2016). This model was assessed for

configural and scalar invariance between student cohorts according to Chen's (2007) recommended cut-off thresholds.

A structural equation model (SEM) provided estimates for all direct paths from Semester 1 achievement goals to Semester 2 appraisals to Semester 2 emotions to Test 6 achievement (see Figure 1). The model also specified synchronous correlations between appraisals of perceived academic control (PAC), and value, as well as correlations between Semester 2 emotions.

The lavaan package for R was used to assess model fit (Rosseel, 2012) and latent models were estimated using maximum-likelihood with robust standard errors (MLR). Direct and indirect relationships were tested for significance using 95% bias corrected confidence intervals (Hayes, 2018; Hayes & Rockwood, 2017).

Zero-Order Correlations (see Table 1)

Correlation coefficients provided an estimate of the unadjusted relationships between study variables. Mastery-approach and performance-approach goals were positively correlated. Mastery-approach goals positively associated with value as well as enjoyment, and negatively associated with boredom. Performance-approach goals related positively to achievement (Test 6 %). In sum, as would be expected, mastery-approach goals correlated positively with control-value appraisals and emotions but showed weaker correlations with performance; performance-approach goals had stronger correlations with performance. Also as expected, PAC correlated negatively with boredom and anxiety, and positively with achievement. Value demonstrated strong associations with enjoyment and boredom. Among the learning-related achievement emotions, anxiety had the strongest relationship with achievement, in a negative direction.

Table 1

Zero-order Correlations of Study Variables

	Variable	1	2	3	4	5	6	7	8	9	10	11
1.	T1 English	—										
2.	T1 Sex	.04*	—									
3.	T1 HSG	-.04*	-.11*	—								
4.	T1 Mastery goals	.07*	-.19*	.05*	—							
5.	T1 Performance goals	-.00	.01	.15*	.37*	—						
6.	T2 PAC	-.13*	.08*	.16*	.09*	.07*	—					
7.	T2 Value	.11*	-.09*	-.03	.38*	.12*	.15*	—				
8.	T2 Enjoyment	.18*	-.01	-.02	.27*	.10*	.06*	.46*	—			
9.	T2 Boredom	-.05*	.06*	-.03	-.22*	.01	-.16*	-.42*	-.29*	—		
10.	T2 Anxiety	.11*	-.12*	-.07*	.07*	.00	-.35*	-.09*	.11*	.20*	—	
11.	T3 Test 6 (%)	-.08*	-.05*	.36*	.06*	.15*	.32*	.12*	.05*	-.06*	-.14*	—
	M	1.24	1.39	8.00	12.25	11.50	31.97	21.15	13.93	14.49	14.16	70.73
	SD	.43	.49	1.58	2.30	2.76	5.50	5.17	3.92	5.03	4.93	16.67

Note. PAC = perceived academic control; HSG = high school grade. Correlations were calculated using pairwise deletion *N* range = 3361-2817. Students who reported English as their first language coded as 0, others coded as 1. Females coded as 0, males coded as 1.

[T1] Semester 1 measure (October). [T2] Semester 2 measure (March). [T3] Semester 2 measure (April).

* $p < .05$ (two−tailed tests).

Measurement Model

Model Invariance. The unconstrained three-group measurement model spanning academic year cohorts 2016-18 demonstrated good model fit (CFI = .92 RMSEA = .034, SRMR = .049; Marcoulides et al., 2020; Vandenberg & Lance, 2000; West et al., 2012). A metric invariance test comparing the unconstrained model and one specifying equal factor loadings across cohorts revealed that goodness of fit did not drop below Chen's (2007) recommended cut-offs (ΔCFI = .001, ΔRMSEA = .000, ΔSRMR = .001). A follow-up scalar invariance test using a model holding factor loadings and intercepts equal across cohorts also showed that goodness of fit did not drop below acceptable thresholds (ΔCFI = .008, ΔRMSEA = .001, ΔSRMR = .002).

Structural Equation Model

Model invariance. An unconstrained three-group structural model yielded good model fit (CFI = .92, RMSEA = .033, SRMR = .045; Marcoulides et al., 2020; Vandenberg & Lance, 2000; West et al., 2012). Structural invariance across cohorts was examined by comparing the unconstrained model with an additional model specifying all predictive paths constrained to be equal across cohorts. Goodness of fit did not drop below Chen's (2007) recommended cut-offs (ΔCFI = .000, ΔRMSEA = .001, ΔSRMR = .001), indicating structural invariance across models. Thus, results are presented based on a single-group model that included student cohort as a covariate predictor for all outcomes.

Hypothesis 1: Goal-Appraisal Relationships. Mastery-approach goals positively predicted PAC (β = .13) and value (β = .50; see Table 2, Figure 1). In contrast, performance-approach goals did not predict PAC, and negatively predicted value (β = −.15), Hypothesis 1 was supported, except for the performance-approach goals → value path which was opposite to that hypothesized.

Hypothesis 2: Appraisal-Emotion Relationships. Semester 2 PAC had a negative association with boredom (β = −.17) and anxiety (β = −.48), but did not relate to enjoyment. Value showed a negative relationship with boredom (β = −.42), and a positive relationship with enjoyment (β = .51), but also with anxiety (β = .10). Hypothesis 2 was supported, excluding the lack of association between PAC and enjoyment.

Hypothesis 3: Indirect Effects of Goals on Emotions. Semester 1 Mastery-approach goals negatively predicted Semester 2 boredom and anxiety through PAC (β = −.02; β = −.06, respectively; Table 3). These goals also had positive indirect predictive effects on enjoyment and anxiety via value (β = .25; β = .05, respectively), along with a negative indirect relationship with boredom (β = −.21). Semester 1 performance-approach goals showed an opposite pattern of indirect relationships with Semester 2 emotions. These goals related to higher boredom (β = .06), and lower enjoyment (β = −.08) and anxiety (β = −.02) through value. Thus, Hypothesis 3 was largely supported for mastery-approach goals, but performance-approach goals demonstrated indirect effects that were not hypothesized.

Hypothesis 4: Emotions-Achievement Relationships. Enjoyment predicted higher Test 6 achievement (β = .06; Table 2, Figure 1), whereas anxiety predicted lower Test 6 achievement (β = −.15).[2] Accordingly, the mastery-approach goals → value → enjoyment pathway, and the mastery-approach goals → PAC → anxiety pathway had positive indirect effects on Test 6 (β = .02; β = .01, respectively).

[2] Due to potential issues of multicollinearity among the achievement emotions, we tested three supplementary models, each of which included only one of the focal emotions (Forsblom et al., 2022). As expected, relationships remained stable, except for emotion-performance linkages. Specifically, boredom negatively predicted test 6 achievement (β = −.08), and the enjoyment-test 6 (β = .07) and anxiety-test 6 relationships increased in magnitude (β = −.16).

In brief, Hypotheses 1 to 4 are largely supported by findings on distal and proximal antecedents of emotions and resulting achievement outcomes. First, students who adopted a mastery approach towards learning in Semester 1 had higher perceptions of control over achievement outcomes and appraised the introductory psychology course as being more valuable as they transitioned into Semester 2. In turn, they experienced greater enjoyment and less boredom during learning activities.

Second, students who endorsed performance-approach goals focused on outperforming others in Semester 1 had lower appraisals of the course's value in Semester 2. This predicted greater feelings of boredom and lower enjoyment during learning activities, but also slightly reduced anxiety over the threat of academic failure.[3]

[3]A post-hoc power analysis based on the smallest observed significant effect (R^2 increase = .007), the given sample size (N = 3361), and α set at .05 showed a statistical power level of 99.5%.

Table 2

Path coefficients for Semester 2 outcomes

Predictor variable	T2 PAC		T2 Value		T2 Enjoyment		T2 Boredom		T2 Anxiety		T3 Test 6 (%)	
	β	95% CIs	*β*	, 95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs
T1 English	-.33	-.408, -.255	.16	.081, .236	.24	.172, .308	-.03	-.099, .044	.07	-.006, .149	-.11	-.190, -.030
T1 Sex	.20	.130, .273	.05	-.031, .121	.09	.025, .152	.04	-.028, .104	-.11	-.176, -.037	-.04	-.107, .037
T1 HSG	.19	.147, .227	-.06	-.095, -.020	-.01	-.043, .030	-.03	-.068, .002	.01	-.027, .050	.33	.299, .364
T1 Mastery goals	.13	.070, .193	.50	.442, .549	.12	.051, .179	-.12	-.188, -.061	.07	.002, .136	.01	-.049, .067
T1 Perf. goals	-.02	-.078, .036	-.15	-.201, -.100	.01	-.045, .059	.10	.052, .154	-.01	-.061, .047	.10	.055, .149
T2 PAC	—	—	—	—	-.04	-.079, .008	-.17	-.211, -.127	-.48	-.515, -.434	—	—
T2 Value	—	—	—	—	.51	.466, .552	-.42	-.464, -.374	.10	.053, .148	—	—
T2 Enjoyment	—	—	—	—	—	—	—	—	—	—	.06	.012, .105
T2 Boredom	—	—	—	—	—	—	—	—	—	—	-.01	-.056, .037
T2 Anxiety	—	—	—	—	—	—	—	—	—	—	-.15	-.190, -.109
R^2	.08		.20		.35		.29		.24		.18	

Note. Perf. Goals = performance goals; PAC = perceived academic control; HSG = high school grade; CI = confidence interval. N = 3361. Students who reported English as their first language coded as 0, others coded as 1. Females coded as 0, males coded as 1. Estimates obtained from a latent structural equation model with full-information maximum likelihood and robust standard errors.

[T1] Semester 1 measure (October). [T2] Semester 2 measure (March). [T3] Semester 2 measure (April).

Table 3

Indirect relationships between goals and emotions through appraisals of PAC and Value

T1 Predictor Variable	T2 Mediating Variable	T2 Outcome Variable	β Standardized indirect effect	Standardized 95% CI lower, upper
Mastery goals	PAC	Enjoyment	−.01	-.011, .002
Mastery goals	Value	Enjoyment	**.25**	.218, .287
Performance goals	PAC	Enjoyment	.00	-.002, .003
Performance goals	Value	Enjoyment	**−.08**	-.103, -.050
Mastery goals	PAC	Boredom	**−.02**	-.034, -.011
Mastery goals	Value	Boredom	**−.21**	-.239, -.176
Performance goals	PAC	Boredom	.00	-.006, .013
Performance goals	Value	Boredom	**.06**	.041, .085
Mastery goals	PAC	Anxiety	**−.06**	-.092, -.032
Mastery goals	Value	Anxiety	**.05**	.026, .074
Performance goals	PAC	Anxiety	.01	-.017, .037
Performance goals	Value	Anxiety	**-.02**	-.024, -.006

Note. PAC = perceived academic control; CI = confidence interval. Indirect effects are presented in standardized metrics. Emboldened values represent significant indirect effects at $p < .05$. $N = 3361$. Estimates obtained from a latent structural equation model with full-information maximum likelihood and robust standard errors.

[T1] Semester 1 measure (October). [T2] Semester 2 measure (March).

Discussion

The school-to-college transition is fraught with novel and unpredictable challenges that may contribute to disruptions in motivation (Perry et al., 2001; Perry, Hall et al., 2005), maladaptive mindsets (Perry et al., 2008), drop-out (Aina et al., 2022; Hamm et al., 2020), and poor emotional health (American College Health Association, 2019; 2023). Students enter this transition period with a unique constellation of individual factors which contribute to their achievement-related emotions and, in turn, their academic persistence and performance (Klapp, 2016; Parker et al., 2022).

However, there is a paucity of research focused on clarifying what are assumed to be distal individual determinants of emotions, particularly during school-college transitions. Hence the present study addressed students' achievement goals as one of the more widely studied, important motivation-related variables. This study is the first to provide longitudinal empirical support for a critical assumption of CVT, namely, that control and value appraisals mediate relationships between achievement goals and achievement emotions (Pekrun, 2006, 2018).

Goals and Appraisals

CVT-derived hypotheses concerning associations between mastery-approach goals and appraisals were largely supported. Semester 1 mastery-approach goals predicted higher Semester 2 PAC. Within CVT, mastery-approach goals are posited to foster control appraisals by focusing attention on the controllability of mastering achievement activities (Pekrun et al., 2009).

Mastery-approach goals predicted higher levels of students’ appraisal of the value of learning in the course over a five-month period. Students’ mastery-approach goals direct their focus toward achieving intra-individual standards of learning (Elliot & McGregor, 2001; Elliot et al., 2011; Urdan & Kaplan, 2020). It thus follows that these goals promote the appraisal of

achievement activities and evaluations as a means for learning and thus being valuable, as consistent with CVT.

In contrast, performance-approach goals predicted lower appraisals of the course's value, a relationship that was not expected. CVT proposes that performance-approach goals focus attention on the positive value of achievement outcomes (Pekrun et al., 2009). However, the current findings suggest that a focus on high achievement relative to others may shift focus away from the perceived importance of the course itself (Murayama & Elliot, 2009).

Performance-approach goals did not predict changes in PAC. According to CVT, these goals are posited to foster appraisals of control by focusing attention on the controllability of achieving normative success relative to others (Pekrun et al., 2006, 2009). The goal of performing well relative to others may not have translated into higher perceptions of control due to the unfamiliar nature of the school-college transition. Research suggests that PAC is relatively unstable in the first semester of college (Respondek et al., 2020). Further, instability in PAC may have been exacerbated by the online learning components in the introductory psychology course for students who likely had little or no experience with online learning (Loderer et al., 2020; Parker, Perry, Chipperfield et al., 2018; You & Kang, 2014).

Appraisals and Emotions

The relationships between appraisals and the emotions largely support CVT and are in line with past research (Forsblom et al., 2022; Parker, Perry, Chipperfield et al., 2018; Parker et al., 2021; Pekrun et al., 2023; Perry et al., 2001; Shao et al., 2019; Tze et al., 2016; 2019). Regarding associations between PAC and emotions, these findings suggest that high levels of PAC contribute to students' emotional well-being. PAC was a salutary predictor of reduced anxiety and boredom. Control-related constructs are among the strongest psychosocial predictors

of college achievement (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017), so it follows that high PAC reduces feelings of anxiety over the threat of failure by aligning students' achievement outcomes with their expectations. This motivation process extends to the negative relationship between PAC and boredom.

For value, the strong magnitudes of association indicate that this appraisal may be particularly important for students' activity emotions. Students who perceived learning and achieving in the course as valuable experienced high enjoyment and low boredom during achievement activities. However, aligned with the study's hypotheses, students who perceived the course as highly important also had higher levels of anxiety. This supports CVT, such that valuing achievement puts greater emphasis on the rewards of success as well as the threat of failure, thus amplifying both positive and negative emotions tied to achievement (Bieg et al., 2013; Frenzel et al., 2007).

Indirect Associations between Goals and Emotions

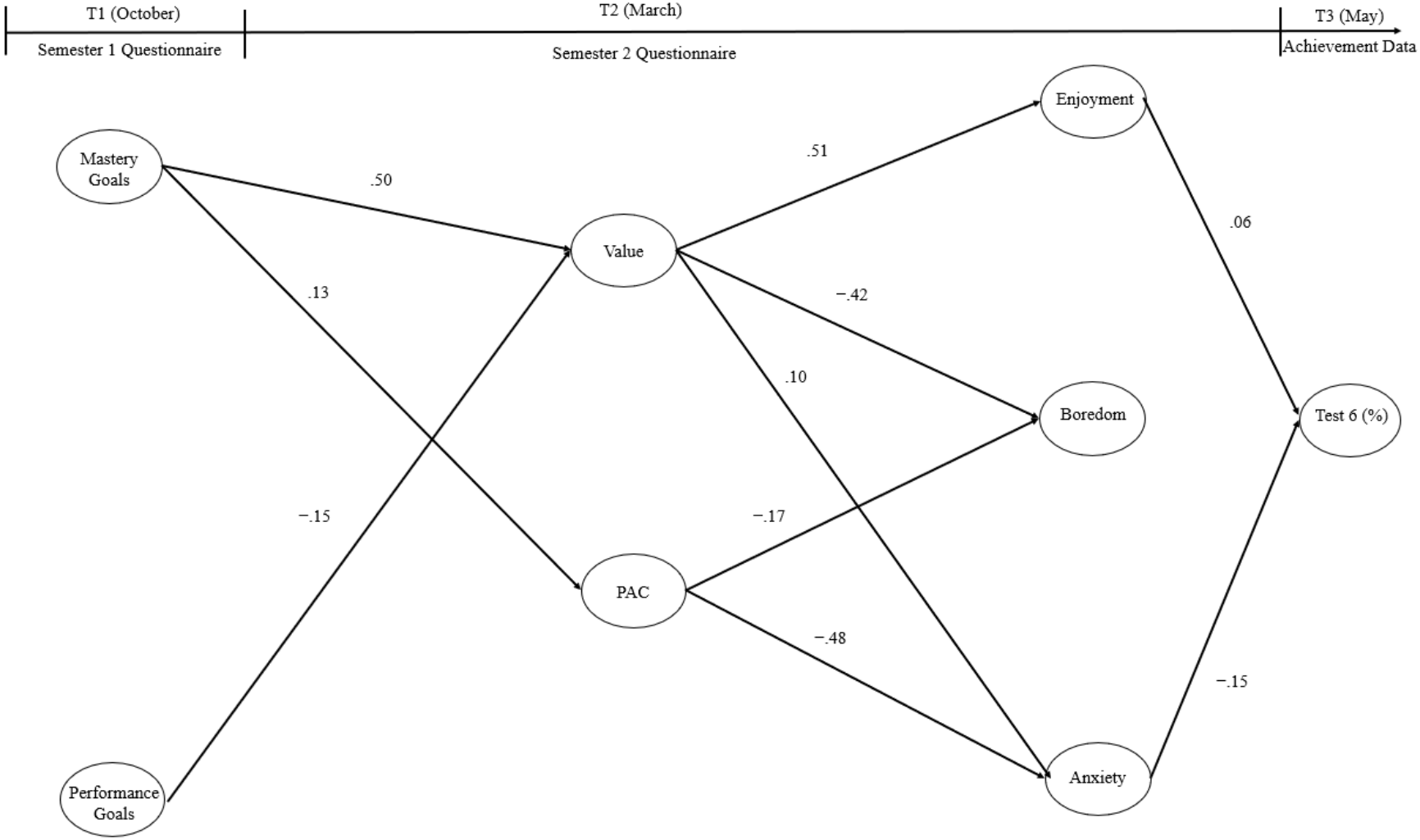
In accordance with CVT, I found that proximal cognitive appraisals mediated relationships between distal mastery- and performance-approach goals and emotions. Semester 1 goals predicted Semester 2 appraisals, which in turn predicted emotions. Mastery-approach goals showed salutary indirect associations with boredom and anxiety through PAC. This pattern of adaptive mediation extended to indirect associations through value, with the exception of contributing to slightly higher levels of anxiety. However, the small maladaptive association between mastery-approach goals and anxiety via value was completely offset by the salutary indirect association through PAC. This supports both CVT and achievement goal theory, which posit uniformly positive effects of mastery-approach goals on students' emotional well-being (Guo et al., 2022; Pekrun et al., 2009; Huang, 2011). Performance-approach goals demonstrated

a largely opposite pattern of indirect associations with emotions. These goals had maladaptive indirect effects on enjoyment and boredom via reduced value.

Taken together, these indirect relationships support CVT (Pekrun et al., 2006, 2009). Despite both mastery- and performance-approach goals directing students' focus towards approaching success, performance-approach goals may be an overall detriment to maintaining adaptive levels of enjoyment and boredom. Mastery-approach goals are adaptive for emotions by virtue of enhanced appraisals of control and value, whereas performance-approach goals may be maladaptive for students' emotions as a function of reducing perceptions of the course's value.

Figure 1

Longitudinal Non-causal Structural Equation Model of Relationships between Achievement Goals, Appraisals, Emotions, and Test 6 (%).



Note. PAC = perceived academic control. N = 3361. Estimates obtained from a latent structural equation model with full-information maximum likelihood and robust standard errors. All paths displayed are significant at $p < .05$. Only significant paths are presented. Sex, first language, and high school grades were included as covariates for all outcomes. Additional significant paths not displayed are as follows: mastery goals-enjoyment (β = .12), mastery goals-boredom (β = −.12), mastery goals-anxiety (β = .07), performance goals-boredom (β = .10), performance goals-Test 6 % (β = .10).

Strengths, Limitations, Future directions

The present study has several strengths. First, this is the only study to date to provide longitudinal empirical support for a critical assumption of Pekrun's (2006, 2018) control-value theory of achievement emotions. In keeping with CVT, control and value appraisals mediated relationships between achievement goals and achievement emotions. In turn, appraisals of control and value were strong antecedents of discrete emotions.

Second, this study featured numerous methodological strengths, including a large sample of students, a longitudinal field design, and latent SEM to test theory-derived hypotheses. These factors offer insight into how motivation processes function over time, coupled with a high degree of statistical power. Third, this study was conducted in the context of students transitioning into a novel competitive learning environment. School-college transitions are fraught with unfamiliar challenges and obstacles to success (Perry, 1991, 2003; Perry et al., 2001, 2005), as evidenced by unacceptably high rates of student failure, drop-out and emotional distress (American College Health Association, 2023; Aina et al., 2022).

Further, research suggests that cognitive appraisals are relatively unstable during the school-college transition (Respondek et al., 2020), whereas students' goals are more enduring (Yau et al., 2021). Thus, this transition period represents an optimal setting to conduct longitudinal assessments of CVT's assumptions concerning distal vs. proximal antecedent of achievement emotions. Finally, I examined students' objective academic achievement as an endmost criterion variable. This provides insight regarding how antecedent affective processes translate into highly meaningful, ecologically valid performance outcomes (Perry & Hamm, 2014; Tunnell, 1977).

One study limitation pertains to the absence of mastery- and performance-avoidance goals, those focused on avoiding loss of mastery and performing worse than others. This study thus does not represent a fully comprehensive examination of CVT's assumptions which also refer to avoidance goals (Elliot et al., 2011; Pekrun et al., 2006, 2009). Future studies could also assess the influence of mastery- and performance-avoidance goals on appraisals and emotions. Further, the longitudinal SEM model did not include auto-lagged relationships. As such, the degree of inference regarding how students' goals predict change in appraisals over time is limited. However, this study is novel in assessing these relationships in a longitudinal framework. These findings thus represent a critical first step in establishing distal vs. proximal predictors of achievement emotions aligned with CVT's assumptions.

The current study lays the groundwork for establishing several paths for further research. Extending this work to include avoidance achievement goals and additional achievement emotions such as hope, pride, happiness, helplessness, shame, regret, and anger would deepen understanding of goal-appraisal-emotion relationships (Pekrun, 2018, 2019).

This focus could be extended by enhancing the frequency of assessment and expanding the study duration beyond a single academic year. This would help to further clarify motivation and emotion processes over time, and how these processes relate to long-term outcomes such as progress within a specific academic domain and college graduation. For example, Hamm et al. (2020) demonstrated that a cognitive-reframing motivation intervention known to enhance PAC improved 8-year graduation rates of struggling first-year students. Relatedly, incorporating tests of reciprocal causation between emotions, antecedents, and their outcomes, as well as interactions between control and value appraisals, would represent a comprehensive approach to testing CVT's underexamined assumptions (Putwain et al., 2018, 2022; Shao et al., 2020).

Notably, the model revealed complete path sequences of goal → appraisal → emotion → achievement mediation processes. Mastery-approach goals indirectly supported higher Test 6 performance by enhancing value, which increased students' course-related enjoyment, which in turn contributed to higher test grades. These goals also enhanced students' perceptions of academic control in Semester 2, which reduced their anxiety over the possibility of poor test performance, which in turn yielded higher test achievement.

These findings suggest that high value appraisals may be adaptive for objective achievement by raising students' positive course-related emotions, whereas PAC may enact salutary effects on achievement by lowering students' negative emotions. Future research aimed at replicating these findings would help to clarify how appraisal-emotion-achievement relationships may differ according to the valence dimension of achievement emotions (i.e., positive vs. negative).

Conclusion

Consistent with CVT, this study suggests that control and value appraisals mediate relationships between achievement goals and achievement emotions. These conclusions offer insights on the potential effects of motivation interventions on emotions (Koenka, 2020). These findings suggest that student-focused interventions designed to enhance mastery-approach goals are likely to promote positive emotions and reduce negative emotions as a function of enhancing appraisals of control and value. Classroom-focused interventions which highlight cooperative goal structures and eschew competitive goal structures should have similar effects (Pekrun, 2018; Urdan & Schoenfelder, 2006).

Regarding appraisal-based treatments, interventions designed to enhance students' PAC are likely to promote uniformly adaptive achievement emotions. For example, an attribution-

based PAC-enhancing treatment known as attributional retraining effectively reduces negative and promotes positive emotions (Dryden et al., 2021; Hamm et al., 2014, 2020; Parker, Perry, Hamm et al., 2018). Value interventions may also be effective for enhancing enjoyment and reducing boredom, but may also increase students' anxiety (Lauermann et al., 2017).

Motivation treatments targeting achievement goals often manipulate performance feedback to encourage mastery- or performance-approach goals (Moning & Roelle, 2021; Muis et al., 2013), or administer writing-based tasks designed to bolster goal adoption (Edwards et al., 2021). However, these treatments show less efficacy compared to those targeting control or value appraisals (Lazowski & Hulleman, 2016). Incorporating goal-based treatment paradigms with established utility-value (Hulleman et al., 2010) or PAC-enhancing treatments (Hamm et al., 2017; Perry et al., 2010) may enhance their psychosocial and achievement benefits.

For example, based on the results of this study, incorporating mastery-oriented feedback into classes which administer value-based writing interventions would likely show greater increases in students' perceived academic value, such that value is enhanced both directly, and indirectly via enhanced mastery goals. Similarly, embedding mastery-goal writing assignments into classes which administer AR treatment protocols may offer meaningful incremental increases in PAC, to the extent that mastery goals indirectly promote academic control. Future goal-based intervention studies could also assess post-treatment PAC and value appraisals, as well as achievement emotions. This expansion of theory-derived outcomes in intervention research would, in part, provide replication evidence for the current study findings.

This study represents a novel, theory-derived synthesis between disparate motivation constructs within the framework of CVT (Elliot et al., 2011; Murayama & Elliot, 2009; Pekrun, 2006; Pekrun & Perry, 2014). Comprehensive knowledge of cognitive, affective, and motivation

processes grounded in empirically validated socio-cognitive theory is needed to understand the core psychosocial factors driving achievement and persistence, as well as defragment emotion research (Linnenbrink-Garcia & Wormington, 2019; Wigfield & Koenka, 2020). Understanding these psychological factors will help to maximize future intervention efficacy according to students' individual differences.

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CHAPTER 4

Study 3

Enjoyment, Boredom, Anxiety: Testing a Model of Reciprocal Feedback Loops

The emotions individuals experience across the lifespan are critical determinants of subjective and objective well-being. In old age, positive and negative emotions predict higher and lower levels of life satisfaction, respectively (Chipperfield et al., 2003). Positive emotions predict adaptive health behaviors such as regular exercise (Newall et al., 2013). The frequency of positive emotions relative to negative emotions is associated with stress, depressive symptomology, and overall psychological functioning (Ruthig et al., 2014). Positive emotions can mitigate the severity of illnesses such as diabetes, cancer, and cardiovascular disease, and reduce the risk of all-cause mortality; these relationships are consistent across cultures and international socioeconomic strata (for reviews see Pressman et al., 2013; 2019).

In the achievement domain, emotions are critical to motivation, and figure prominently in leading theories of motivation such attribution theory (Weiner, 1985, 2014, 2018), the broaden-and-build theory of positive emotions (Fredrickson, 2001), and the control-value theory of achievement emotions (CVT; Pekrun, 2006; Pekrun & Perry, 2014). However, research on emotion remains in a state of fragmentation both within and across research disciplines (Adolphs, 2017; Feldman-Barrett, 2017; Pekrun & Perry, 2014), and critical assumptions of leading theories remain underexamined. The purpose of this study is to test CVT's model of reciprocal feedback loops using a methodologically robust design which features stronger theoretical alignment with CVT than past studies (Pekrun et al., 2014, 2017).

Achievement Emotions

Emotions, generally, are multi-component dynamic processes of psychological and biological systems. Each discrete emotion can be characterized according to its affective, cognitive, motivational, expressive, and physiological components (Pekrun, 2006). In terms of neurophysiology, an emotion is the subjective experience of certain states of the nervous system, particularly the neural substrates of the limbic system of the brain (Fellous & LeDoux, 2005; Panksepp, 1998). This is a phylogenetically older system than the brain's neocortex, attesting to the profound importance of emotion in the evolutionary history and survival of the human race.

Achievement emotions, specifically, are those which are directly related to achievement activities (e.g., studying, assignment work) or outcomes (e.g., test performance, final grades). The experience of achievement emotions, as with emotions more generally, can be distinguished between momentary occurrences at a specific point in time (i.e., state achievement emotions), or habitual, repeating patterns of emotion typically experienced by an individual in relation to specific achievement settings, activities, and outcomes (i.e., trait achievement emotions). CVT categorizes achievement emotions within a 2 × 2 × 2 dimensional taxonomy organized in terms of object focus, valence, and physiological activation. Achievement emotions can have a positive (e.g., hope) or negative valence (e.g., anxiety), be physiologically activating (e.g., anger) or deactivating (e.g., boredom), and focus on academic outcomes (e.g., pride, shame) or activities (e.g., boredom, enjoyment; Pekrun & Perry, 2014).

In competitive achievement contexts such as college learning environments, CVT posits that emotions play a causal role in students' overall performance, persistence, and attainment of long-term achievement goals such as graduation. Specifically, CVT organizes the determinants of achievement along a distal-proximal continuum ordered as follows: environmental factors-appraisals-emotions-behaviors-achievement. That is, environmental factors such as the goal

structures and expectations fostered in classrooms are assumed to influence appraisals of perceived control and value, which serve as the proximal determinants of emotions. Emotions, in turn, are posited to indirectly influence objective achievement outcomes (i.e., GPA, graduation) through their effects on information processing, cognitive resources such as selective attention, motivation to achieve, and students' use of self-regulated learning strategies such as elaborative learning strategies.

Elaborative Learning

Cognitive elaboration refers to a deep learning strategy in which individuals connect and integrate novel information with existing knowledge (Pintrich et al., 1993, 1994). Elaborative learning has been described as the primary means through which the learning experience can be fully appreciated (Entwistle, 2000). Research consistently demonstrates positive associations between elaborative learning strategies and objective achievement outcomes such as final grades in introductory college courses, cumulative college GPA, and performance in medical school (Hall et al., 2004, 2007; Hamm et al., 2017; Hayat et al., 2020). Meta-analyses of college achievement report positive associations between cognitive elaboration and GPA (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017).

CVT delineates the effects of discrete emotions on elaborative learning according to their dimensional properties within the 2 x 2 x 2 taxonomy. Positive activating emotions (e.g., enjoyment) are proposed to facilitate these strategies as a means to deeply engage with learning. CVT posits that negative activating emotions (e.g., anxiety) promote shallow strategies for learning such as rigid rehearsal because the salient threat of academic failure reduces cognitive resources needed for deep, elaborative learning. Negative deactivating emotions (e.g., boredom) are also presumed to undermine elaborative learning strategies, and instead encourage minimal

engagement and superficial processing of learning materials. Empirical evidence supporting these proposed relationships is mixed.

Di Leo et al. (2019) examined the influence of enjoyment, boredom, and anxiety on deep learning approaches to mathematics problem solving for fifth and sixth grade students using a cross sectional design. The authors found that boredom negatively predicted deep strategy use; enjoyment and anxiety did not predict the use of deep learning strategies. King et al.'s (2014) cross-sectional study found that both enjoyment and anxiety positively predicted cognitive elaboration in a large sample of high school students from the Philippines, whereas boredom did not predict elaboration. An additional cross-sectional study indicated that enjoyment positively predicted elaborative learning and boredom negatively predicted elaborative learning for undergraduate students in online learning conditions (Artino & Jones, 2012). Meta-analyses of achievement emotions show that cognitive elaboration is positively predicted by enjoyment, and negatively predicted by boredom and anxiety (Loderer et al., 2018; Tze et al., 2015).

Longitudinal studies provide further insight into relationships between achievement emotions and learning strategies. Ahmed et al., (2013) conducted a 1-year latent growth curve analysis focused on emotions and learning strategies in a sample of 7th grade students. Consistent with CVT, the authors found that enjoyment negatively predicted use of shallow learning strategies and reduction of shallow strategies over time, and positively predicted use of elaborative learning and growth in elaboration. In contrast, boredom positively predicted shallow learning strategy use and growth over time; boredom was unrelated to deep strategy use, and anxiety did not predict learning strategies.

Muis et al., (2015) tested mediation models consistent with CVT in a sample of 5th grade students in a 5-day daily diary methodological framework. The researchers found that boredom

negatively predicted deep learning strategies and anxiety predicted shallow learning strategies; enjoyment did not predict use of deep or shallow learning strategies. Boredom had a negative indirect effect on math achievement through reduction of deep learning strategies, whereas anxiety had a positive indirect effect on achievement through shallow learning strategies. Ranelucci et al., (2015) tested similar mediation models in an undergraduate sample over two years. They found that cognitive elaboration mediated positive relationships between learning-related enjoyment and cumulative GPA. However, neither boredom or anxiety significantly predicted elaborative learning strategies.

These cross-sectional and longitudinal studies focused on relationships between achievement emotions, learning strategies, and achievement largely align with the propositions of CVT. However, the methodological designs noted above ignore an important corollary of CVT regarding the interplay of motivation factors as causal determinants of overall achievement, namely, CVT's proposed model of reciprocal causation.

Reciprocal Causation

CVT organizes the factors which influence achievement across an ostensibly linear temporal sequence. However, CVT posits that these relationships are influenced by principles of reciprocal causation which account for cyclical relationships between motivation processes. For example, achievement outcomes are presumed to influence aspects of the learning environment such as teachers' expectations and emotions when interacting with students. Further, achievement outcomes inform individuals' appraisals of perceived control; failure experiences undermine control while success promotes greater perceptions of control, which in turn influence emotions. These reciprocal relationships create feedback loops between learning environments, appraisals, emotions, cognition and motivation, and achievement, which can either bolster or

subvert achievement and persistence. Recent empirical studies provide support for CVT's model of reciprocal causation.

Pekrun et al. (2014) conducted a 1-year longitudinal study examining reciprocal relationships between boredom and achievement in an undergraduate student sample. The researchers found evidence of feedback loops between boredom and achievement, such that boredom predicted lower initial achievement, which in turn predicted higher levels of boredom. These relationships held when controlling for prior boredom and achievement for each subsequent assessment, thus demonstrating that boredom predicted lower achievement beyond the effects of past performance, and vice-versa. Pekrun et al., (2017) replicated and extended this research with a five-year study in a large sample of fifth grade students. The authors found reciprocal relationships between achievement and discrete positive (enjoyment, pride) and negative emotions (anxiety, shame, anger, hopelessness, boredom) in the expected directions; separate models were tested for each discrete emotion.

Studies have also focused on reciprocal relationships between achievement and central constructs within CVT other than emotions such as perceived control. Arens et al., (2017) demonstrated reciprocal relationships between math achievement and self-concept of math ability, a component of perceived control, in an elementary school sample tracked from Grades five through nine. Respondek et al., (2020) conducted a 3-year discrete time-survival analysis in which perceived control and GPA showed reciprocal relationships in an undergraduate student sample. Further, changes in GPA were found to mediate relationships between changes in perceived control and college drop-out.

Recently, Putwain et al., (2018) demonstrated reciprocal relationships between enjoyment, boredom, and achievement over 1-year in a sample of elementary school students.

The authors' methodological approach was innovative due to the inclusion of both emotions in the same structural equation model. Putwain et al., (2020) replicated and extended this work to include anxiety; they found reciprocal relationships between anxiety and achievement in the expected direction. However, boredom and enjoyment did not show reciprocal relationships with achievement when all three emotions were included in the same model. The authors interpreted these findings as indicating that anxiety has the most deleterious effects on achievement and subsequent emotions relative to enjoyment and boredom.

Three notable limitations underscore extant research on CVT's proposed model of indirect relations that incorporates the feedback loop from achievement to subsequent appraisals. First, with the exception of Putwain et al. (2018, 2020), studies have tested separate reciprocal models for each discrete emotion. This precludes scientific inference regarding the strength of reciprocal relationships between discrete emotions and achievement relative to other emotions. Second, the majority of studies used samples of elementary school students. It is possible that reciprocal relationships demonstrated in elementary school do not generalize to other student populations such as first-year college students undergoing the transition from high school to college. Emotional distress is common for students struggling to adapt to these unfamiliar learning environments (Perry et al., 2008; Pekrun et al., 2002). Replications and extensions of reciprocal feedback loop models in this student population may offer insight towards improving the emotional well-being and achievement of students during this challenging developmental transition. Finally, no study to date has tested models of reciprocal indirect feedback loops fully aligned with CVT's proposed model. That is, studies have exclusively focused on emotions and achievement, or appraisals and achievement. To date, no study has tested models of reciprocal relationships which fully align with CVT by including other important motivation factors

implicated as mediators in reciprocal processes such as control and value appraisals, emotions, and learning strategies such as cognitive elaboration.

Study Aims and Hypotheses

This study corrects for the limitations of prior research on reciprocal indirect feedback loops by examining reciprocal relationships between appraisals, emotions, cognitive elaboration, and achievement using a large-scale multi-cohort sample of first-year college students tracked over one year. Enjoyment, boredom, and anxiety were selected as the focal achievement emotions given their prominence in the literature and the need to clarify mixed findings regarding relationships between these emotions and elaborative learning. Further, these emotions were included in a single model rather than treated separately to provide insight into their relations with motivation factors relative to the other emotions. Hypotheses are as follows:

H1: Time 1 PAC and value appraisals will positively predict Semester 1 enjoyment, and negatively predict Semester 1 boredom and anxiety.

H2: Semester 1 enjoyment will positively predict Semester 1 cognitive elaboration; Semester 1 anxiety and boredom will negatively predict Semester 1 cognitive elaboration.

H3: Semester 1 cognitive elaboration will positively predict Semester 1 achievement.

H4: Semester 1 achievement will positively predict Semester 2 control and value appraisals.

H5: Hypotheses 1-3 will be replicated for all Semester 2 variables while controlling for autoregressive effects of Semester 1 baseline assessments.

Methods

Participants

This longitudinal field study comprised first-year students from a two-semester introductory psychology course at a research-intensive university in western Canada (N = 1457). Two cohorts of introductory psychology students from 1997-99 participated[4]. The majority of students were female (60.0%), between 17-20 years old (86.0%), and spoke English as their first language (88.6%). All participants completed the Semester 1 questionnaire.

Some students who completed the Semester 1 questionnaire did not complete the Semester 2 questionnaire (N = 1457 vs. 1096; 24.4%). I performed Little's missing completely at random (MCAR; Little, 1988) test for missing data, followed by a series of t-tests between students with complete vs. incomplete data. Little's test was statistically significant ($p < .001$), indicating a lack of MCAR data. Follow-up t-test attrition analyses revealed that students who responded to the Semester 2 questionnaire (vs. non-responders) represented a higher proportion of females, had higher high school grades and baseline levels of cognitive elaboration, and lower baseline levels of boredom and anxiety. These differences were small on average.

To the extent that baseline variables could account for missing data, I included them as covariates for all outcomes, treated data as missing at random (MAR), and adjusted for missing data using full information maximum likelihood (FIML) estimation. FIML is the recommended approach to handle missing data in longitudinal studies (Jeličić et al., 2009) and produces unbiased estimates for MAR data when variables causing missingness are included in the model (Nicholson et al., 2017).

Procedure

Data collection occurred during three phases of each academic year. In *Phase 1* at the start of Semester 1 (October), questionnaires were administered and completed in a laboratory

[4] This cohort range was selected to ensure consistency across data materials.

context. PAC, perceived value, elaborative learning strategies, enjoyment, boredom, anxiety, age, and sex data were collected during *Phase 1*. In *Phase 2* (March) students returned to the laboratory to complete the Semester 2 questionnaire via the same administration procedures. Semester 2 PAC, perceived value, elaborative learning strategies, enjoyment, boredom, and anxiety data were collected were collected during *Phase 2*. In *Phase 3*, upon completion of the course (May), students' objective cumulative GPAs across Semesters 1 and 2 were obtained from institutional records. This study used data from a larger 25-year project on student motivation and academic achievement (MAACH; see Hamm et al., 2020; Perry et al., 2008; Perry, Hladkyj et al., 2005; Perry, 2003). This precluded an examination of shallow learning strategies such as rote rehearsal and memorization, because they were not available in The MAACH archival database. The project was approved by the institution's Psychology and Sociology Research Ethics Board. All students provided consent for their questionnaire and achievement data to be used for research purposes.

Predictor Variables (see Table 1 for *M*s, *SD*s)

Perceived Academic Control (PAC; Semester 1). Perry et al.'s (2001) eight-item PAC scale measured students' perceptions of control (1 = *strongly disagree*, 5 = *strongly agree*) over their achievement outcomes (e.g., "The more effort I put into my courses, the better I do in them;"; Perry, Hladkyj et al., 2005). Four items were negatively worded and reverse coded (e.g., "No matter what I do, I can't seem to do well in my courses"). The scale had adequate internal consistency (Cronbach's α = .75) and good test-retest reliability (r = .53), in keeping with previous research (Cronbach's α range = .75 – .81, test-retest correlation range = .58 – .67, Haynes et al., 2006; Pekrun et al., 2010; Perry et al., 2001, 2010; Ruthig et al., 2009; see Appendix A).

Perceived Academic Value (Semester 1). A five-item course-specific academic value scale assessed students' appraisal of the course's value (1 = *strongly disagree,* 5 = *strongly agree*). The scale included items pertaining to perceptions of intrinsic value (e.g., "I think that what we learn in my introductory psychology course is interesting") and extrinsic value ("It is extremely important for me to do well in my Introductory Psychology course"). The value scale showed acceptable psychometric reliability (Cronbach's α = .65) and good test-retest reliability (r = .60; see Appendix I).

Mediator/Outcome Variables (see Table 1 for *M*s, *SD*s)

Enjoyment, Boredom, and Anxiety (Semester 1). Course-specific scales each consisting of six-items included in Pekrun et al.'s (2011) Achievement Emotions Questionnaire (AEQ) assessed the three following CVT-related emotions (1 = *strongly disagree,* 5 = *strongly agree)*: enjoyment ("I enjoy doing my assignments"); boredom ("This course bores me to death"); anxiety ("I worry my assignments might be too difficult"). The enjoyment and anxiety scales had adequate internal consistency (Cronbach's α range = .72; .79, respectively). The boredom scale had good psychometric reliability Cronbach's α range = .88). Each emotion scale demonstrated good test-retest reliability (r range = .62 – .69), consistent with the AEQ literature (Buhr et al., 2019; Frenzel et al., 2007; Pekrun et al., 2011; see Appendices J-L).

Cognitive Elaboration (Semester 1). Six items adapted from Pintrich et al.'s (1989) elaborative learning scale gauged students' use of elaborative learning strategies (e.g., "I try to understand the material in this class by making connections between the readings and the concepts from the lectures"). The cognitive elaboration scale showed adequate psychometric reliability (Cronbach's α = .77) and good test-retest reliability (r = .54), in keeping with past

studies (Cronbach's α range = .77–.84, test-retest correlation range = .51–.59, Hall et al., 2004, 2007; Hamm et al., 2017; Ranelucci et al., 2015; see Appendix M).

Semester 1 Cumulative GPA. Students' Semester 1 GPA obtained from institutional records represented their overall achievement. GPA comprised the average grade received in all university courses during students' first semester of studies. GPA was recorded as a numerical value having letter grade equivalents as follows: 0 = F, 1 = D, 2 = C, 2.5 = C+, 3 = B, 3.5 = B+, 4 = A, 4.5 = A+.

Perceived Academic Control (PAC; Semester 2). Students responded to a follow-up PAC assessment in Semester 2 (Cronbach's α = .79; Perry et al., 2001)

Perceived Academic Value (Semester 2). The same five-item value scale measured students' perceptions of academic value in Semester 2 (Cronbach's α = .65).

Enjoyment, Boredom, Anxiety (Semester 2). Three six-item scales identical to those used in Semester 1 gauged students' levels of enjoyment (Cronbach's α = .73), boredom (Cronbach's α = .90), and anxiety (Cronbach's α = .80) in Semester 2.

Cognitive Elaboration (Semester 2). Students completed Pintrich et al.'s (1989) elaborative learning scale in Semester 2.

Term 1 Cumulative GPA. Students' Term 1 GPA obtained from institutional records comprised the average grade received in all university courses during the first two semesters of studies.

Covariates

High School Grades (%). Students' high school grades were obtained from the Office of Institutional Analysis. These data represent the objective overall average (%) students achieved across their courses in the final year of high school.

Demographics. Students indicated their age (1 = *17–18*, 10 = *older than 45*), and sex (1 = *female*, 2 = *male*) through single-item self report measures.

Cohort. Student annual two-semester cohorts were coded into a dummy variable (0 = *1997-98*, 1 = *1998-99*).

Results

Rationale for Analyses

First, I assessed whether the data met the assumptions for OLS regression analysis (normality, linearity, homoscedasticity). A regression-based path model was used to test hypotheses pertaining to reciprocal relations between appraisals, emotions, elaborative learning, and achievement.

Estimates were derived from a single fully forward path model. In accordance with CVT, I specified a sequence of paths in the following order: $\text{appraisals}_{T1} \rightarrow \text{emotions}_{T1} \rightarrow \text{elaborative learning}_{T1} \rightarrow \text{GPA}_{T2} \rightarrow \text{appraisals}_{T3} \rightarrow \text{emotions}_{T3} \rightarrow \text{elaborative learning}_{T3} \rightarrow \text{GPA}_{T4}$. This model specification enabled assessment of reciprocal relationships, such that all significant direct and indirect effects on subsequent outcomes accounted for relevant baseline and concurrent motivation factors. The model also specified synchronous correlations between appraisals of perceived academic control (PAC), and value, as well as correlations between Semester 2 emotions.

I used the lavaan package for R to calculate the effects of predictor and mediator variables. Direct and indirect relationships were tested for significance using 95% bias corrected confidence intervals (Hayes, 2018; Hayes & Rockwood, 2017).

Zero-order Correlations (see Table 1).

Correlation coefficients provided an estimate of the unadjusted relationships between the study variables. PAC and value were positively correlated, showed positive associations with enjoyment, elaboration, and GPA, and negatively associated with boredom. PAC had a negative relationship with anxiety, whereas value had no association. Notably, PAC had a stronger association with GPA compared to value. Value had stronger relationships with enjoyment, boredom, and elaboration relative to PAC.

Enjoyment positively related to elaboration but had no association with GPA. In contrast, boredom and anxiety showed a negative association with elaboration and GPA. Boredom and anxiety were positively related, and had a negative association with enjoyment. Cognitive elaboration correlated positively with GPA. Semesters 1 & 2 longitudinal relationships were of a lower magnitude than cross-sectional correlations, but otherwise consistent.

Table 1

Zero-Order Correlations of Main Study Variables

	Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17.
1.	T1 Age	—																
2.	T1 Sex	.01	—															
3.	T1 High School %	−.49	.02	—														
4.	T1 PAC	−.04	.05	.07	—													
5.	T1 Value	.08	−.11	.00	.22	—												
6.	T1 Enjoyment	.10	−.02	−.10	.16	.39	—											
7.	T1 Boredom	−.09	.17	.03	−.24	−.41	−.38	—										
8.	T1 Anxiety	−.01	−.03	−.05	−.26	−.02	−.06	.36	—									
9.	T1 Elaboration	.02	−.16	.07	.17	.43	.31	−.32	−.10	—								
10.	T2 GPA	−.01	−.08	.19	.17	.13	−.03	−.10	−.11	.20	—							
11.	T3 PAC	.01	.00	.05	.53	.25	.16	−.24	−.27	.23	.20	—						
12.	T3 Value	.09	−.12	−.01	.18	.60	.33	−.40	−.10	.37	.20	.34	—					
13.	T3 Enjoyment	.11	.04	−.12	.12	.29	.64	−.32	−.03	.28	.00	.22	.40	—				
14.	T3 Boredom	−.13	.17	.08	−.14	−.32	−.37	.69	.25	−.30	−.10	−.33	−.45	−.40	—			
15.	T3 Anxiety	−.04	.04	−.03	−.16	−.10	−.06	.31	.62	−.10	−.12	−.29	−.13	−.01	.39	—		
16.	T3 Elaboration	.03	−.13	.02	.12	.33	.30	−.27	−.08	.54	.19	.24	.43	.36	−.34	−.11	—	
17.	T4 GPA	−.04	−.08	.22	.16	.17	−.01	−.16	−.16	.24	.82	.23	.24	.04	−.17	−.14	.23	—
	M	1.70	1.40	72.34	33.53	19.77	19.52	12.93	15.23	28.03	2.71	33.34	19.05	19.25	14.11	14.73	28.45	2.64
	SD	1.18	.49	20.88	4.15	3.08	3.97	5.04	4.79	6.66	.96	4.11	3.40	4.03	5.49	4.81	6.81	.94

Note. PAC = perceived academic control. Correlations were calculated using pairwise deletion *N* range = 1457-1096. Females coded as 0, males coded as 1.

[T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December). [T3] Semester 2 measure (March). [T4] End of Semester 2 measure (May). All correlations $\geq |.06| = p < .01$ (two-tailed).

Hypothesis 1: Semester 1 Appraisal-emotion Relationships (see Table 2, Figure 1). Consistent with Hypothesis 1, PAC predicted increased enjoyment (β = .08), and decreased boredom (β = −.17) and anxiety (β = −.27). Value was associated with increased enjoyment (β = .37), and decreased boredom (β = −.35). Contrary to Hypothesis 1, value had no association with anxiety.

Hypothesis 2: Semester 1 Emotion-elaboration Relationships (see Table 2, Figure 1). In alignment with Hypothesis 2, enjoyment predicted increased levels of elaborative learning (β = .15), whereas boredom predicted decreased elaboration (β = −.09). Hypothesis 2 was not supported for anxiety, as it showed no association with elaboration. In accordance with CVT, PAC and value indirectly predicted increased elaborative learning via increased enjoyment (β = .01; β = .06, respectively), and decreased boredom (β = .02; β = .03, respectively).

Hypothesis 3: Semester 1 Elaboration-GPA Relationships (see Table 2, Figure 1). As hypothesized, students' elaborative learning strategies predicted increased Semester 1 GPA across all courses (β = .15). Consistent with CVT, higher levels of enjoyment indirectly predicted increased GPA via elaboration (β = .02), whereas boredom showed an opposite indirect relationship (β = −.01).

Table 2

Regression Coefficients for Semester 1 Emotions, Elaborative Learning, and Overall GPA

Predictor variable	T1 Enjoyment		T1 Boredom		T1 Anxiety		T1 Elaboration		T2 GPA	
	β	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs
T1 High School %	-.085	-0.139, -0.031	.008	-0.044, 0.061	-.060	-0.117, -0.003	.098	0.046, 0.150	.199	0.143, 0.254
T1 Sex	.014	-0.033, 0.062	.143	0.097, 0.189	-.010	-0.061, 0.040	-.110	-0.156, -0.064	-.069	-0.111, -0.010
T1 Age	.034	-0.021, 0.088	-.067	-0.120, -0.014	-.054	-0.111, 0.004	.025	-0.028, 0.078	.094	0.038, 0.150
T1 PAC	.077	0.028, 0.125	-.173	-0.221, -0.126	-.266	-0.316, -0.216	.043	-0.006, 0.092	.123	0.071, 0.175
T1 Value	.370	0.324, 0.416	-.349	-0.394, -0.304	.044	-0.008, 0.096	.310	0.259, 0.360	.064	0.004, 0.123
T1 Enjoyment	—	—	—	—	—	—	.153	0.101, 0.204	-.119	-0.175, -0.064
T1 Boredom	—	—	—	—	—	—	-.093	-0.150, -0.036	-.010	-0.072, 0.051
T1 Anxiety	—	—	—	—	—	—	-.042	-0.092, 0.009	-.058	-0.112, -0.004
T1 Elaboration	—	—	—	—	—	—	—	—	.153	0.097, 0.208
R^2	.17		.22		.07		.24		.11	

Note. PAC = perceived academic control; CI = confidence interval. *N* = 1457. Females coded as 0, males coded as 1. Estimates obtained from regression-based path model with full-information maximum likelihood and robust standard errors.
[T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December).

Hypothesis 4: Semester 1 GPA-Semester 2 PAC and Value Relationships (see Tables 3 & 5, Figure 1). Hypothesis 4 was fully supported. Students' Semester 1 overall GPA predicted increased levels of PAC (β = .09), and value (β = .12). Elaborative learning predicted increased PAC and value appraisals through increased Semester 1 GPA (β = .01; β = .02, respectively).

Hypothesis 5: Replicating Semester 1 Relationships (see Tables 4 & 5, Figure 1). Relationships between Semester 2 appraisals, emotions, elaborative learning, and GPA were almost wholly consistent with Semester 1. PAC and value predicted increased enjoyment (β = .10; β = .25, respectively), and decreased boredom (β = −.21; β = −.18, respectively). PAC was associated with decreased anxiety (β = −.16), but value showed no association with anxiety.

In turn, enjoyment related to increased use of elaborative learning strategies (β = .15), and boredom predicted decreased use of elaborative learning (β = −.08). Consistent with Semester 1 relationships, anxiety had no association with cognitive elaboration. In contrast to Hypothesis 5, the positive association between Semester 2 elaboration with overall term GPA was not significant.[5] [6]

[5]A post-hoc power analysis based on the smallest observed significant effect (R^2 increase = .02), the given sample size (N = 1457), and α set at .05 demonstrated a statistical power level of 99.8%.

[6]A supplementary latent variable model showed results that were largely consistent with the primary regression model. Fit indices demonstrated good model fit (CFI = .91, RMSEA = .029, SRMR = .049). T1 PAC positively predicted T1 enjoyment (β = .07), and negatively predicted T1 boredom (β = −.20), and T1 anxiety (β = −.31). T1 value positively predicted T1 enjoyment (β = .58), and negatively predicted T1 boredom (β = −.41). T1 elaboration was positively predicted by T1 enjoyment (β = .23), and negatively predicted by T1 boredom (β = −.09). T1 elaboration positively predicted T2 GPA (β = .21), which positively predicted T3 PAC (β = .09) and T3 value (β = .08). T3 PAC positively predicted T3 enjoyment (β = .12), and negatively predicted T3 boredom (β = −.27), and T3 anxiety (β = −.18). T3 value positively predicted T3 enjoyment (β = .28), and negatively predicted T3 boredom (β = −.17). T3 enjoyment positively predicted T3 elaboration (β = .22).

Table 3

Regression coefficients for Semester 2 Appraisals and Emotions

Predictor variable	T3 PAC		T3 Value		T3 Enjoyment		T3 Boredom		T3 Anxiety	
	β	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs	*β*	95% CIs
T1 High School %	.014	-0.042, 0.071	-.006	-0.059, 0.047	-.050	-0.102, 0.002	.027	-0.020, 0.073	-.020	-0.073, 0.034
T1 Sex	-.004	-0.054, 0.045	-.035	-0.081, 0.011	.090	0.045, 0.135	.050	0.009, 0.091	.043	-0.004, 0.089
T1 Age	.022	-0.036, 0.079	.028	-0.026, 0.081	.023	-0.029, 0.075	-.047	-0.095, 0.000	-.031	-0.085, 0.023
T1 PAC	.449	0.402, 0.496	.012	-0.036, 0.060	-.031	-0.085, 0.022	.110	0.062, 0.159	.081	0.026, 0.136
T1 Value	.094	0.036, 0.153	.473	0.422, 0.524	-.126	-0.187, -0.066	.105	0.051, 0.160	-.058	-0.120, 0.004
T1 Enjoyment	.016	-0.038, 0.071	.054	0.003, 0.105	.555	0.511, 0.599	-.083	-0.129, -0.038	.029	-0.022, 0.080
T1 Boredom	-.015	-0.077, 0.047	-.159	-0.216, -0.103	-.056	-0.113, 0.000	.614	0.571, 0.656	.068	0.009, 0.127
T1 Anxiety	-.134	-0.188, -0.080	.008	-0.043, 0.058	.070	0.020, 0.120	-.022	-0.067, 0.023	.588	0.545, 0.630
T1 Elaboration	.065	0.009, 0.121	.060	0.008, 0.112	.049	-0.002, 0.100	-.016	-0.062, 0.030	.031	-0.022, 0.083
T2 GPA	.088	0.037, 0.139	.123	0.075, 0.170	-.046	-0.093, 0.002	.004	-0.039, 0.047	-.017	-0.066, 0.032
T3 PAC	—	—	—	—	.097	0.042, 0.151	-.211	-0.261, -0.161	-.163	-0.220, -0.107
T3 Value	—	—	—	—	.253	0.196, 0.311	-.181	-0.234, -0.128	.018	-0.042, 0.078
R^2	.34		.42		.45		.55		.41	

Note. PAC = perceived academic control; CI = confidence interval. *N* = 1457. Females coded as 0, males coded as 1. Estimates obtained from regression-based path model with full-information maximum likelihood and robust standard errors.
[T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December). [T3] Semester 2 measure (March).

Table 4

Regression coefficients for Semester 2 Elaborative Learning, and Overall GPA

Predictor variable	T3 Elaboration		T4 GPA	
	β	95% CIs	β	95% CIs
T1 High School %	.000	-0.055, 0.055	.071	0.037, 0.105
T1 Sex	-.046	-0.095, 0.002	.000	-0.030, 0.030
T1 Age	-.031	-0.087, 0.025	-.009	-0.043, 0.024
T1 PAC	-.027	-0.085, 0.030	-.031	-0.069, 0.006
T1 Value	-.052	-0.117, 0.013	.035	-0.007, 0.077
T1 Enjoyment	-.004	-0.067, 0.059	-.047	-0.089, -0.005
T1 Boredom	.049	-0.025, 0.124	.002	-0.047, 0.051
T1 Anxiety	.026	-0.039, 0.091	-.057	-0.100, -0.014
T1 Elaboration	.420	0.369, 0.471	.030	-0.008, 0.068
T2 GPA	.057	0.006, 0.107	.775	0.752, 0.797
T3 PAC	.054	-0.007, 0.115	.031	-0.013, 0.075
T3 Value	.210	0.145, 0.276	.005	-0.043, 0.054
T3 Enjoyment	.149	0.085, 0.212	.014	-0.033, 0.061
T3 Boredom	-.078	-0.152, -0.004	-.063	-0.117, -0.008
T3 Anxiety	-.032	-0.095, 0.032	.019	-0.029, 0.066
T3 Elaboration	—	—	.034	-0.009, 0.077
R^2		.38		.69

Note. PAC = perceived academic control; CI = confidence interval. N = 1457. Females coded as 0, males coded as 1. Estimates obtained from regression-based path model with full-information maximum likelihood and robust standard errors.
[T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December). [T3] Semester 2 measure (March). [T4] End of Semester 2 measure (May).

Table 5

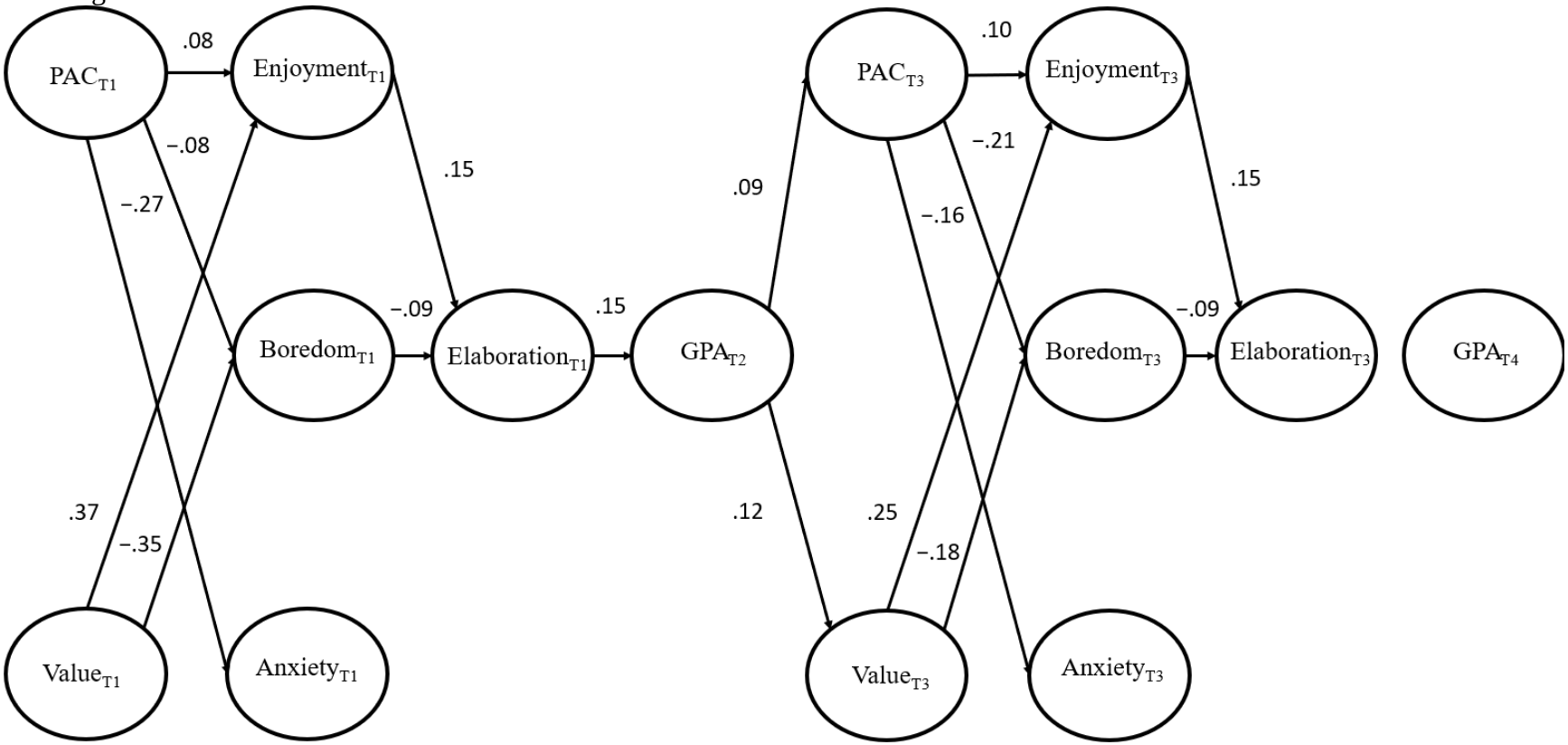
Indirect Relationships between Appraisals, Emotions, Elaborative Learning, and Overall GPA

Predictor Variable	Mediating Variable	Outcome Variable	β Standardized indirect effect	Standardized 95% CI lower, upper
T1 PAC	T1 Enjoyment	T1 Elaboration	**.012**	0.003, 0.020
T1 Value	T1 Enjoyment	T1 Elaboration	**.056**	0.036, 0.077
T1 PAC	T1 Boredom	T1 Elaboration	**.016**	0.005, 0.027
T1 Value	T1 Boredom	T1 Elaboration	**.032**	0.012, 0.053
T1 PAC	T1 Anxiety	T1 Elaboration	.011	-0.003, 0.025
T1 Value	T1 Anxiety	T1 Elaboration	-.002	-0.005, 0.001
T1 Enjoyment	T1 Elaboration	T2 GPA	**.023**	0.012, 0.035
T1 Boredom	T1 Elaboration	T2 GPA	**-.014**	-0.024, -0.004
T1 Anxiety	T1 Elaboration	T2 GPA	-.006	-0.014, 0.002
T1 Elaboration	T2 GPA	T3 PAC	**.013**	0.004, 0.023
T1 Elaboration	T2 GPA	T3 Value	**.019**	0.009, 0.029
T2 GPA	T3 PAC	T3 Enjoyment	**.009**	0.002, 0.015
T2 GPA	T3 Value	T3 Enjoyment	**.031**	0.017, 0.045
T2 GPA	T3 PAC	T3 Boredom	**-.019**	-0.030, -0.007
T2 GPA	T3 Value	T3 Boredom	**-.022**	-0.033, -0.011
T2 GPA	T3 PAC	T3 Anxiety	**-.014**	-0.024, -0.005
T2 GPA	T3 Value	T3 Anxiety	.002	-0.005, 0.010
T3 PAC	T3 Enjoyment	T3 Elaboration	**.014**	0.004, 0.025
T3 Value	T3 Enjoyment	T3 Elaboration	**.016**	0.000, 0.032
T3 PAC	T3 Boredom	T3 Elaboration	.005	-0.005, 0.016
T3 Value	T3 Boredom	T3 Elaboration	**.038**	0.019, 0.056
T3 PAC	T3 Anxiety	T3 Elaboration	**.014**	0.000, 0.028
T3 Value	T3 Anxiety	T3 Elaboration	-.001	-0.003, 0.002
T3 Enjoyment	T3 Elaboration	T4 GPA	.005	-0.002, 0.012
T3 Boredom	T3 Elaboration	T4 GPA	-.003	-0.007, 0.002
T3 Anxiety	T3 Elaboration	T4 GPA	-.001	-0.004, 0.001

Note. PAC = perceived academic control; CI = confidence interval. Indirect effects are presented in standardized metrics. Emboldened values represent significant indirect effects at $p < .05$. $N = 3361$. Estimates obtained from a regression-based path model with full-information maximum likelihood and robust standard errors. [T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December). [T3] Semester 2 measure (March). [T4] End of Semester 2 measure (May).

Figure 1

Longitudinal Non-Causal Regression-based Path Model of Reciprocal Relationships between Appraisals, Emotions, Elaborative Learning and Overall GPA.



Note. PAC = perceived academic control. N = 1457. Estimates obtained from a regression-based path model with full-information maximum likelihood and robust standard errors. All paths displayed are significant at $p < .05$. Only significant, and most proximal paths are presented to enhance clarity. Age, sex, and high school grades (%) were included as covariates for all outcomes. Baseline levels of all Semester 1 variables were included as covariates for all Semester 2 outcomes. See Tables 2-4 for all regression paths. [T1] Semester 1 measure (October). [T2] End of Semester 1 measure (December). [T3] Semester 2 measure (March). [T4] End of Semester 2 measure (May).

Discussion

Individuals' emotions are critical determinants of healthy adaptation across all stages of the lifespan, influencing outcomes such as subjective well-being, objective health indicators, and mortality (Chipperfield et al., 2003; Newall et al., 2013). Maintaining high levels of positive emotions may be most crucial during major life-course transitions, such as starting a new career, getting married, having a baby, or retiring (Heckhausen et al., 2010; Perry, 2003). Individuals have no relevant personal experience for how to successfully adapt to these novel stages of life. As such, the novel and unfamiliar challenges unique to each discrete transition can be difficult to overcome without the support of adaptive emotions.

The school-to-college transition is salient amongst these developmental shifts. Students entering the first year of college often must adapt to competitive goal structures, a lack of personal supervision from teachers or mentors, novel financial stressors, complex administrative requirements, and academic setbacks (Perry et al., 2001; 2005). These environmental factors, among others, contribute to the high levels of negative emotions first-year college students experience, including anxiety, helplessness, and hopelessness (American College Health Association, 2019).

However, some students thrive during their transition from high school and across their college experience. This is due, in part, to their trait-like experience of high positive discrete emotions and low negative discrete emotions (Hamm et al., 2017; Parker et al., 2018). This corroborates contemporary theories of motivation and emotion such attribution theory (Weiner, 1985, 2014, 2018), the broaden-and-build theory of positive emotions (Fredrickson, 2001), and CVT (Pekrun, 2006; Pekrun & Perry, 2014). Important assumptions of CVT regarding the antecedents, consequences, and temporal sequence of emotions with psychosocial and

achievement factors remain unknown or underexamined. This study fills a knowledge gap by testing CVT's principle of reciprocal indirect relationships forming feedback loops in a novel methodological paradigm, more closely aligned with theory than past studies (Pekrun et al., 2014; Putwain et al., 2018; 2020).

Appraisals and Emotions

As hypothesized (H1), PAC appraisals fostered feelings of enjoyment, and reduced feelings of boredom and anxiety. This is consistent with CVT, and largely consistent with past research (Buhr et al., 2019; Niculescu et al., 2015; Parker, Perry, Chipperfield, Hamm et al., 2018; Tze et al., 2021). Although some studies report mixed findings regarding relationships between PAC and the activity emotions enjoyment and boredom (Goetz et al., 2019; Hall et al., 2016), the negative predictive effect of PAC on anxiety is one of the strongest and most consistent findings in the achievement emotion literature (Bieg et al., 2013; Perry et al., 2001; Ruthig et al., 2008; Shao et al., 2020; Stupnisky et al., 2013; Turner et al., 2002). This is in contrast to appraisals of academic value, which typically show the strongest predictive effects on enjoyment and boredom, and inconsistent relationships with anxiety (Frenzel et al., 2007; Goetz et al., 2020; Lauermann et al., 2017).

Within CVT, value theoretically amplifies feelings of anxiety and other negative emotions by increasing students' cognitive emphasis on the importance of success and, accordingly, the threat of failure. However, inconsistent findings regarding value-anxiety relationships highlight the clarifying role in distinguishing between intrinsic and extrinsic value within CVT. Specifically, appraisals of extrinsic value more closely pertain to the negative consequences of failure outcomes, which may account for why positive relationships between extrinsic and undifferentiated value scales are more commonly reported than with measures of

intrinsic value (Bieg et al., 2013; Frenzel et al., 2007; Goetz et al., 2006; Hall et al., 2016; Lauermann et al., 2017; Parker et al., 2021; Shao et al., 2020). This study used an undifferentiated value scale, which likely contributed to its non-significant relationship with anxiety. This was the only component of Hypothesis 1 that was not supported.

Emotions and Elaborative Learning Strategies

In accordance with Hypothesis 2, students' feelings of course-related enjoyment led to increased use of elaborative learning strategies when engaging with course content, whereas course-related boredom had the opposite effect. This is consistent with CVT (Pekrun, 2006; Pekrun & Perry, 2014). Theoretically, the positive-activating activity emotion enjoyment enhances the cognitive resources needed to apply this deep learning strategy during academic activities (e.g., studying) and increases intrinsic motivation to remain engaged with these activities. In contrast, boredom is posited to deplete cognitive resources and encourage shallow learning strategies and motivation to avoid these activities. Further, PAC and value appraisals had adaptive indirect predictive effects on elaborative learning via increased enjoyment and decreased boredom.

Anxiety showed no significant association with cognitive elaboration. Thus, Hypothesis 2 was not fully supported. CVT proposes that anxiety, a physiologically activating emotion, may motivate students to remain engaged with academic activities such as studying as a means to avoid failure. However, the subjectively negative feeling of anxiety also theoretically reduces cognitive resources and leads to shallow learning strategies such as rote rehearsal/memorization (Pekrun, 2006). Prior studies report non-significant, or even positive, associations between anxiety and elaborative learning strategies. CVT does acknowledge that as a negative-activating

emotions, the effects of anxiety are ambiguous and often difficult to predict. Future research is need to clarify these relationships.

Cognitive Elaboration, Achievement, and Reciprocal Feedback Loops

In support of Hypothesis 3, students' reported use of elaborative learning strategies early in Semester 1 (October) led to higher objective Semester 1 GPA across all courses. This corroborates CVT as well as the broaden-and-build theory's perspective that deep engagement with achievement activities involving connecting new knowledge with prior, and often disparate, concepts is an effective means for learning (Di Leo et al. 2019; King et al., 2014). Notably, the positive association between Semester 1 cognitive elaboration and GPA was slightly larger in magnitude than that of PAC, which recent meta-analyses report as the strongest psychosocial predictor of objective achievement (Richardson et al., 2012; Robbins et al., 2004; Schneider & Preckel, 2017). This also aligns with CVT, which posits that motivated behaviors and cognitive strategies are the proximal determinants of achievement.

The temporal sequence delineating proximal vs. distal antecedents of each salient category of psychosocial factors within CVT is further supported by the indirect effects observed in the current study. That is, appraisals exerted indirect effects on elaborative learning through boredom and enjoyment. These emotions, in turn, had indirect effects on Semester 1 GPA via elaborative learning. Consistent with Hypotheses 4 and 5, Semester 1 achievement predicted higher PAC and value appraisals (H4), which then demonstrated the same appraisal-emotion-elaboration sequence and pattern of indirect effects (H5). This shows that while appraisals can influence achievement through emotions and deep learning strategies, so to can achievement outcomes effect change on future appraisals, thus supporting CVT's principle of reciprocal causation. The only component of H5 that was not supported pertained to the lack of association

between Semester 2 cognitive elaboration with overall term GPA. This is likely due to the very high amount of variance accounted for this outcome by Semester 1 GPA ($\beta = .75$). However, this finding is inconsistent with CVT, which predicts that learning strategies should show effects on achievement above and beyond that of prior achievement (Pekrun, 2018).

Strengths, Limitations, Future Directions

This study has several noteworthy strengths. First, this is the only study to test clear, theory-derived hypotheses concerning reciprocal causation in a model which includes appraisals, emotions, learning strategies, and objective achievement outcomes. This corrects for the limitations of past studies focused on either appraisal-achievement, or emotion-achievement reciprocal relationships (Arens et al., 2017; Pekrun et al., 2014; 2017; Respondek et al., 2020). Further, all focal emotions were included in the same model, which provides insight into the effects of discrete emotions relative to one another. Notably, it appears that increasing students' learning-related enjoyment and decreasing their boredom may yield greater motivational benefits than focusing on regulating students' anxiety, a conclusion consistent with CVT and past research (Pekrun, 2006; Pekrun et al., 2010).

Second, this study used strong methodological practices. This study used a relatively large sample of students, a longitudinal field design, and objective achievement indicators including precise measures of high school grades (%) and Semesters 1 & 2 GPA to test theory-derived hypotheses. Tunnell (1977) argues that objective and ecologically meaningful outcomes such as these are critical to scientific rigor and insights towards causality.

Third, this study focused on first-year students undergoing the school-college transition. First-year college students experience high rates of failure, course withdrawal, emotional distress, and college drop-out (De Brey et al., 2021; Respondek et al., 2017; Ruthig et al., 2004).

Thus, examining relationships between salient motivation and emotion constructs within this population can better inform practices to improve these outcomes for struggling students than past research focused on elementary school students (Di Leo et al., 2019; Muis et al., 2014).

One study limitation pertains to the measurement of value. The value scale used in the current study had rather low psychometric reliability, and was not based on established scales used in past CVT-focused research. The scale combined items assessing both intrinsic and extrinsic value, which precluded a more fine-grained analysis better aligned with CVT. However, the relationships, both bivariate and within the primary regression model, were consistent with past research, suggesting an acceptable level of convergent and divergent validity.

Another variable limitation concerns the lack of shallow learning strategies such as rehearsal/memorization. These strategies were not available in the MAACH archival database, which precluded their inclusion in the study's reciprocal feedback loop model. CVT proposes specific emotional antecedents and learning outcomes for shallow strategies (Pekrun, 2006; Pekrun et al., 2023). Shallow learning behaviors thus represent an important component with CVT's proposed model of reciprocal motivational processes. Rehearsal strategies have been shown to positively relate to objective achievement outcomes, but with small magnitudes relative to deep learning strategies (Song & Chung, 2020).

An additional limitation concerns the relatively few number of assessments of students' psychosocial motivation factors. Students' appraisals, emotions, and elaborative learning were only measured twice, in contrast to past studies focused on reciprocal motivation processes (Pekrun et al., 2014; 2017; Putwain et al., 2018; 2020). Many of reported relationships were cross-sectional rather than longitudinal, and thus not ideal for demonstrating CVT's reciprocal

feedback loop over time. However, the comprehensive set of covariates between Semesters 1 and 2, and the inclusion of students' objective high school grades as an indicator of baseline achievement strengthen evidence in favor of reciprocal relationships.

This study provides several avenues for future research. First, the one-year longitudinal timespan could be replicated with additional periods of psychosocial measures, akin to assessment protocols of prior studies while also including all relevant appraisal, emotion, and learning strategy variables. Incorporating established scales of intrinsic and extrinsic value, measures of shallow learning strategies such as rehearsal, and additional underexamined emotions such as relief, anger, and hope would provide opportunities for further empirical validation of CVT's assumptions (Pekrun et al., 2002; 2011). Finally, extending the longitudinal timespan of this study beyond a single year would offer valuable insights into whether these relationships persist after a single academic year, and if appraisal, emotion, and learning strategies ultimately predict highly meaningful long-term achievement outcomes such as college graduation (Hamm et al., 2020).

Conclusion

To date, this is the first ever study to test CVT's model of a reciprocal feedback loop in a single model including appraisals, multiple salient emotions, learning strategies, and objective achievement outcomes. In line with CVT, predictive relationships followed a reciprocal appraisal-emotion-learning-achievement-appraisal etc. sequence, which was then almost fully replicated at a 5-month follow-up. These findings also support other contemporary motivation theories such as attribution theory (Weiner, 1985, 2014, 2018), and the broaden-and-build theory (Fredrickson, 2001), such that students' emotions encouraged motivation to engage in deep learning behaviors.

This study suggests that student-focused or environment-focused interventions designed to enact salutary change on any of the focal constructs within CVT can influence the other factors by the principle of reciprocal feedback loops. For example, an attribution-based motivation intervention commonly referred to as attributional retraining (AR) has proven effective in competitive achievement settings (Haynes et al., 2009; Perry & Hamm, 2017). These interventions enhance students' PAC by encouraging adaptive causal thinking after achievement setbacks (Dryden et al., 2021; 2023). Specifically, students reframe these setbacks around controllable, rather than uncontrollable causes. Attributional retraining interventions have demonstrated efficacy for students with low PAC, high boredom, and low elaborative learning strategies (Dryden et al., 2021; Hamm et al., 2017; Parker et al., 2018).

This study represents a unique, theory-derived synthesis between motivation constructs that are often overlooked within the framework of CVT (Pekrun, 2006; 2018). Strong evidence regarding cognitive, affective, and motivation processes grounded in empirically validated socio-cognitive theory is needed to understand the core psychosocial factors driving achievement and persistence, as well as defragment emotion research (Linnenbrink-Garcia & Wormington, 2019). Understanding these psychological factors will help to maximize future intervention efficacy according to students' individual differences.

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CHAPTER 5

General Discussion

"There is nothing as practical as a good theory." Renowned motivational psychologist Kurt Lewin claimed this in 1943, and it could not be truer today in the field of social psychology. Social psychological research is now recovering from revelations within the past decade pertaining to a lack of empirical fidelity and replicability in social psychological research (Open Science Collaboration, 2015; Muthukrishna & Henrich, 2019). However, ad hoc studies in this field focused on examining novel social psychological phenomena are still common (McPhetres et al., 2021). These types of studies are not without merit, but when they lack an explicit theoretical framework, it is difficult to connect new evidence to past findings, which stymies the progress of cumulative scientific knowledge (Eronen & Bringmann, 2021; Stroebe, 2016). Further, when a study or body of studies guided by a specific theory are siloed within that theory exclusively, the extent to which these studies can integrate and consolidate knowledge of social psychological processes is limited (Elliot et al., 2023).

Pekrun's (2006) control value theory of achievement emotions (CVT) is a contemporary appraisal-based framework for understanding motivation and emotion in competitive achievement settings. CVT incorporates perspectives from theories of perceived control (Perry, 1991), attribution theory (Weiner, 1985; 2014; 2018), achievement goal theory (Elliot et al., 2011), and theories of self-regulated learning (Fredrickson, 2001; Pintrich et al., 1994). However, few empirical studies centered around CVT acknowledge these additional theoretical perspectives (Linnenbrink-Garcia & Barger, 2014). This dissertation comprised three interrelated studies grounded in CVT, but each had a unique focus on prior theoretical perspectives on

motivation. All studies centered around student participants in a competitive learning environment, the majority of which were undergoing to transition from high school to college.

The school-college transition is set to a backdrop of unfamiliar learning environments and paradigms (e.g., online learning, blended learning), increased competition and personal responsibility, unstable social networks, and socioeconomic stressors (Dryden et al., 2022; 2023). These factors, among others, contribute to decreased perceptions of control, disruptions in motivation, academic failure, drop-out, and high levels of emotional distress (Aina et al., 2023; Liu et al., 2020; Perry et al., 2014; Sahu et al., 2020). The three empirical studies featured in this dissertation examined the proximal and distal antecedents and outcomes of students' emotions as they adapt to this challenging transition. These studies provide robust evidence towards empirically validating CVT's overlooked assumptions, and have the potential to improve students' emotional, motivational, and achievement outcomes through theory-informed student-focused and environment-focused practices.

Study 1 investigated CVT's assumption that control and value appraisals have a multiplicative effect on students' achievement emotions. That is, control-emotion relationships depend on levels of value, and value-emotion relationships depend on levels of control. This study integrated perspectives from Weiner's (1985; 2014; 2018) attribution theory by including students' initial achievement outcomes as a potential third moderator of Control × Value interactions. Important, negative, and/or unexpected outcomes (e.g., test failure) are central within attribution theory, as they theoretically instigate causal search processes leading to attributions and discrete emotions. Within CVT, the dimensional properties of causal attributions such as locus and controllability are considered to be components of perceived control. Further, CVT distinguishes between achievement emotions that are activity-focused (e.g., enjoyment) or

outcome-focused (e.g., pride), which implies that outcome-focused emotions should show stronger relationships with academic outcomes such as exam performance.

Study 2 focused on constructs assumed to be distal or proximal determinants of achievement emotions within CVT. The central proposition of this theory states that control and value appraisals are the strongest determinants of students' discrete achievement emotions. Accordingly, these appraisals are viewed as the most proximal antecedents of emotions. In contrast, other established predictors of students' emotions are distal antecedents, which exert indirect effects on emotions by impacting control and value appraisals. Study 2 integrated salient constructs in Elliot's achievement goal theory (Elliot & McGregor, 2001; Elliot et al., 2008; 2011) within a CVT-derived longitudinal mediational model. Specifically, students' mastery- and performance-approach goals assessed in Semester 1 were predicted to influence Semester 2 emotions by changing perceptions of control and value. Achievement goals can be seen as both environmental factors and individual difference variables, as classroom environments initially communicate either cooperative or competitive goal structures to students. Notably, the transition to college is often a student's first experience with a highly competitive learning environment which encourages the need to do better than one's peers to succeed.

Study 3 empirically examined the reciprocal relationships between motivation factors proposed by CVT. Motivation constructs are organized along a distal-proximal continuum of emotion antecedents with the following temporal order: environment-appraisals-emotions-behaviors-achievement. However, an important caveat to this theoretical scaffold is that each category of motivation factors can reciprocally influence the other categories. For example, high achievement on an important exam can increase students' perceptions of control over future exams, and the extent to which they value success. Additionally, engaging in effective learning

behaviors can influence emotions, such as increasing enjoyment while studying and/or reducing anxiety about anticipated failure. This study incorporated elements of Fredrickson's (2001) broaden-and-build theory of positive emotions by including elaborative learning strategies. Briefly, Fredrickson's theory states that positive emotions enhance creativity, learning, and achievement in varied contexts by providing the energy, intrinsic motivation, and cognitive resources needed for flexible and/or unconventional problem-solving. CVT adopts a similar perspective.

Appraisals and Achievement: Interactive Effects on Emotions

Few empirical studies have focused on interactions between PAC and value predicting achievement emotions in competitive learning environments. The small extant literature typically supports CVT, such that control shows stronger salutary relationships with positive and negative emotions at high (vs. low) levels of value. However, these studies also reflect critical theoretical omissions. These include focus on only a limited range of achievement emotions, omitting students' achievement outcomes as an additional moderator aligned with the activity- vs. object-focus of emotions, and framing appraisal emotion-relationships exclusively around PAC. Critically, value-emotion relationships are less consistent compared to PAC, which suggests that testing how these associations depend on PAC may better clarify theoretical propositions.

In keeping with CVT, PAC × Value relationships emerged for all nine discrete emotions. In general, these interaction effects support past research such that salutary relationships with emotions increased in magnitude with appraisals. However, the inclusion of students' initial test performance as a third moderator offers crucial insights aligned with the emotion dimensions of objective focus (activity vs. outcome), and valence (positive vs. negative).

For the activity emotions enjoyment and boredom, students' Test 1 performance had no predictive effect. That is, despite the critical importance of an early achievement outcome during the transition to college, students' actual performance did not impact how much they experience enjoyment or boredom during course-related activities. Test 1 performance did, however, clarify the association between PAC and enjoyment. Students' levels of PAC predicted higher enjoyment only when they had high initial performance. This suggests that students may need to see their efforts toward exerting academic control 'pay off' before the experience of control-focused behaviors is enjoyable.

The predictive effects of appraisals and achievement for the positive outcome-emotions hope and pride were distinct from enjoyment and boredom. Students' initial achievement outcomes positively predicted these outcome-emotions. This supports CVT's object-focus distinction, and attribution theory's perspective that important outcomes, even when they are expected and/or positive, lead to discrete emotions. The interactions between these antecedents provide a more nuanced understanding of student emotion. For hope, PAC had the strongest association at low levels of value and Test 1 achievement. Theoretically, hope is a positive emotion that also implies a degree of uncertainty/instability about future outcomes. These findings support this perspective. When students experience setbacks and their perceived value is in question, PAC becomes crucial for maintaining hope that future outcomes will improve. In contrast, when students perform well and their academic value is high, the certainty of future success circumvents the need for hope, and PAC instead becomes a stronger predictor of pride and enjoyment.

Findings pertaining to negative outcome-emotions showcase the critical importance of PAC and value for maintaining emotional well-being following academic setbacks. For each of

these emotions, the PAC × Value interaction emerged only at low levels of initial achievement. Critically, for students who experienced an academic setback (i.e., grade of D or F) and reported low PAC, value was a positive predictor of anxiety, and had no relationship with shame, regret, or helplessness. However, for students who maintained high PAC despite this important setback, their academic value also served a protective role against these emotions. Taken together, Study 1 clearly demonstrates how high levels of control and value contribute to students' emotion and motivation, particularly after academic setbacks.

Achievement Goals: Distal Predictors of Emotions

There is a large body of literature focused on the associations between achievement goals and achievement emotions. However, the vast majority of studies are framed exclusively within Elliot's (Elliot et al., 2011) achievement goal theory. Further, research that does incorporate perspectives from goal theory and CVT has notable omissions. These studies either do not include critical theory-derived variables such as PAC and value appraisals (Pekrun et al., 2006; 2009), or use strictly cross-sectional models (Hall et al., 2016), which limits the degree to which inferences can be made regarding proximal vs. distal determinants of emotion. Thus, Study 2 represents the first ever empirical test of CVT's assumption concerning goal-emotion relationships in a longitudinal framework.

In accordance with CVT, students' Semester 1 achievement goals predicted change in their appraisals of PAC and value at a 5-month follow-up. Mastery-approach goals associated with increased PAC and value, and performance-approach goals related to decreased value. In turn, appraisals predicted Semester 2 emotions. Consistent with the literature, PAC negatively predicted boredom and had a strong negative effect on anxiety (Ruthig et al., 2008; Shao et al.,

2020). Value was a strong salutary predictor of enjoyment and boredom (Goetz et al., 2020; Noteborn et al., 2012), but also related to increased anxiety (Frenzel et al., 2007).

Contrary to CVT's perspective, performance-approach goals did not predict increased PAC (Pekrun et al., 2006; 2009). As discussed, this lack of association may be due to the unfamiliar nature of the novel college environment, and specifically online course instruction. However, an additional consideration pertains to the school-to-college transition more broadly. K-12 educational environments rarely encourage competitive goal structures (Huang et al., 2011). Thus, the first year of college is likely the first time students experience competitive goal structures, in which their success may require or imply another's failure. Students' performance goals themselves may have been just as unfamiliar as the competitive learning environment, which may account for why these goals did not translate into higher PAC (Harackiewicz et al., 2002; Huang et al., 2011.

In the final step of the longitudinal goal-appraisal-emotion path model, boredom and anxiety predicted decreased final course grades. This is in keeping with past research (Tze et al., 2016, 2021; Shao et al., 2019). However, this path model is not strictly aligned with CVT, which specifies learning behaviors and cognitive strategies as the most proximal antecedents of objective achievement. Study 3 corrects for this omission.

Elaborative Learning, Achievement, and Reciprocal Causation

Within CVT, emotions are assumed to influence factors such as motivation to achieve, self-regulation, cognitive resources, and learning strategies which in turn, collectively, determine achievement (Pekrun, 2006; Pekrun & Perry 2014). Study 3 incorporated this perspective through a model specifying emotions as the most proximal antecedents of elaborative learning strategies, and elaboration as the most proximal determinant of overall GPA.

As predicted, enjoyment associated with increased use of these learning strategies, whereas boredom related to decreased use. This aligns with CVT. Enjoyment, as a positive, physiologically activating activity emotion is posited to encourage flexible learning strategies by providing energy, and reducing the cognitive load required to maintain attention and focus. Boredom, as a negative, physiologically deactivating emotion should have the opposite effect on these factors.

In contrast to predictions, anxiety showed no association with elaborative learning strategies. Theoretically, as a negative but physiologically activating emotion, anxiety may motivate students to engage in academic activities, but also promote shallow processing of learning material. Studies examining emotion-learning relationships rarely include multiple emotions in the same model (Putwain et al., 2018; 2022). Accordingly, Study 3 indicates that enjoyment and boredom have a stronger influence on learning behavior during academic activities than anxiety.

As hypothesized, cognitive elaboration was a meaningful predictor of students' overall GPA. This positive relationship had the second-highest magnitude of all predictors, with students' objective high school average as the highest magnitude. This attests to the validity of CVT's propositions, and the high degree of empirical fidelity in Study 3's objective achievement indicators. Further, every predicted step in the temporal path model was largely supported. Critically, Semester 1 GPA associated with increased Semester 2 PAC and value appraisals above-and-beyond the associations of Semester 1 baselines, which began a sequence of reciprocal causation in Semester 2. Thus, Study 3 corrected for the omissions of past research on reciprocal motivation processes by including appraisals, multiple emotions, and learning strategies in a single model.

Implications for Motivation Treatment Interventions

Each of the three interrelated studies within this dissertation provide evidence-based implications for how to maximize efficacy of future motivation treatments. For Study 1, as previously noted (see Study 1 discussion), incorporating PAC into value-based interventions (e.g., Hulleman et al., 2010), or including value in PAC-based interventions (e.g., Perry et al., 2010) may clarify for whom the treatment is most effective, and under what conditions enhanced appraisals lead to the most positive outcomes. PAC-enhancing interventions may be most effective for students with low PAC and high value, whereas value-enhancing interventions may be most effective for students with high PAC and low value. To date, no appraisal-based intervention studies have examined both PAC and value in tandem as moderators of treatment efficacy.

Further, value-based treatment interventions often do not include achievement emotions as post-treatment outcome variables (Rosenzweig et al., 2022). Based on the results of Studies 1-3, future value-oriented intervention studies would likely benefit from broadening the scope of outcomes to include enjoyment and boredom. Value appraisals consistently demonstrate strong salutary relationships with these activity emotions, which suggests that value-enhancing interventions may also boost these emotions. Critically, future studies could also assess students' post-treatment anxiety, to ensure that interventions designed to increase value appraisals do not inadvertently raise students' anxiety levels (Lauermann et al., 2017).

Findings from Study 2 carry implications for how appraisal-based interventions may incorporate aspects of goal-based interventions (e.g., Moning & Roelle, 2021; Muis et al., 2013) to supplement treatment efficacy. For PAC-enhancing intervention studies, it may be beneficial to include mastery-oriented performance feedback to supplement boosts in PAC with indirect

boosts in value as a result of heightened mastery goals. Conversely, it is possible that implementing performance-oriented feedback experimental protocols may strengthen the positive impact of value interventions on achievement outcomes. Performance-approach goals consistently demonstrate stronger positive relationships with objective achievement outcomes than mastery-goals (Senko, 2019). To the extent that value-based interventions may compensate for any small indirect negative effects of performance-approach goals on value, merging aspects of these interventions may yield a more comprehensive set of positive outcomes.

Study 3 demonstrated a reciprocal feedback loop consistent with CVT (Pekrun et al., 2023). In keeping with CVT, this implies that interventions which directly target appraisals, emotions, or learning strategies will have cascading effects which positively augment the reciprocal appraisal-emotion-learning-achievement cycle. Interventions designed to encourage elaborative learning strategies demonstrate efficacy, but are rarely administered in competitive achievement settings with high ecological validity (McDaniel, 2023). Interventions which target achievement emotions directly may be more conducive for the effects of lab-administered treatments to generalize across real-world contexts (Tze et al., 2022).

Recent advances in emotion-focused interventions show promise. Krispenz et al. (2019) administered an inquiry-based stress reduction treatment to anxious German undergraduate students. Students attended a 3-hour seminar in which they completed exercises involving sequential checklists intended to cognitively reframe anxiety-provoking thoughts. The treatment boosted students' self-efficacy, which in turn reduced anxiety and academic procrastination. This treatment exclusively targeted students' anxiety. However, the focus on cognitive reframing leading to enhanced self-efficacy shares critical features with established AR treatment paradigms (Perry & Hamm, 2017). Tze et al. (2024) conducted a pilot study assessing the impact

of an intervention targeting academic boredom. Students viewed a brief video detailing the antecedents and outcomes of boredom, and how certain cognitive reframing techniques can effectively reduce boredom. After a brief consolidation exercise, students took a post-video quiz which showed that they held fewer misbeliefs about boredom relative to their pre-video quiz scores.

Overall, the implications of Studies 1-3 suggest that targeted motivation interventions may yield greater efficacy if implemented in a combined and complementary fashion (Cromley et al., 2020). AR videos and consolidation exercises could be combined with value-enhancing writing activities as a means of targeting both types of appraisals. Similarly, value-based treatments could be combined with anxiety-reduction treatments to mitigate potential threats of maladaptive value-anxiety relationships. As with each of Studies 1-3's unique focus on a different aspect of theory integration, the integration of theory-derived motivation interventions is a path towards a consolidated set of interventions to yield maximum efficacy according to students' individual needs.

Strengths, Limitations, Future Directions

This dissertation has several noteworthy strengths. The first strength pertains to quality of measures and methodological design. All three studies included objective performance indicators as either moderator (Study 1) or outcome measures (Study 2 & 3). According to Tunnell (1977), these objective performance variables with high ecological validity are critical to the fidelity of empirical findings. Each study used several important demographic covariates (e.g., sex, first language) which have been shown to influence academic success (Comeaux & Harrison, 2011). Further, Studies 2 and 3 used a longitudinal design, and included a comprehensive set of covariates to test theory-derived hypotheses. These factors offer insight into change in

motivation factors over time. Each of the three studies had a high degree of statistical power, with a combined total of more than 8000 unique participants.

Second, this dissertation focused on newly enrolled students undergoing the transition to college. This transition is characterized by a multitude of unfamiliar and novel challenges, leading to high rates of failure, drop-out, and emotional distress (Perry et al., 2005; 2010). This is an ideal context to empirically investigate motivation and emotion processes, as findings contribute to the development of evidence-based practices that can bolster student resilience (Pekrun, 2018).

Third, all of the studies are grounded in a rich theoretical framework based on Pekrun's (2006; 2018; Pekrun & Perry, 2014) control-value theory of achievement emotions. Studies 1-3 empirically investigated a different critical, yet overlooked, assumption of CVT through clear, theory-derived hypotheses. Notably, each study incorporated elements of other prominent social cognitive motivation theories. In the case of Study 2 and 3, these efforts towards theoretical synthesis were explicitly delineated within CVT. For Study 1, the inclusion of students' initial test performance as a potential moderator of PAC × Value interactions was a novel extension of both CVT and Weiner's (1985; 2014; 2018) attribution theory.

The dissertation strengths noted above are, in part due, to the use of the Motivation and Academic Achievement (MAACH) archival database. The MAACH archive (1992–2018) represents a world-class database in terms of sample size, richness of measures, and longitudinal framework. Each study spanned several years of participants, controlling for cohort, and varied in terms of traditional classroom learning and assessment, and contemporary online and/or blended learning paradigms. The consistency of findings across years, environments, and similar

yet distinct measurement scales suggests a high degree of replicability and scientific rigor regarding the empirical support for CVT's propositions.

One general limitation of this dissertation is that none of the studies included an experimental manipulation. Accordingly, definitive scientific inferences regarding cause-effect relationships cannot be made. However, the high degree of statistical power, consistency of findings, use of established and validated PAC and emotion scales (Perry et al., 2001; Pekrun et al., 2011), and sophisticated methodological designs and longitudinal models help to mitigate this limitation.

Another limitation applicable to this dissertation, broadly, pertains to issues of generalizability. The participants represent introductory psychology students from a single Midwestern Canadian university, which may not generalize to other competitive, or non-competitive, learning environments. However, the use of large samples spanning multiple years, demographic covariates, and general consistency with past research utilizing international samples may allay concerns regarding generalizability.

One final limitation pertains to the static nature of the MAACH archival database used to empirically validate critical assumptions of CVT. That is, despite the richness of the MAACH archive in terms of theory-relevant psychosocial, sociodemographic, and achievement data, certain critical variables were not available. For example, psychometrically validated scales were not available for achievement emotions such as pride, shame, and regret (Study 1). Performance-avoidance goals focused on not performing worse than student peers, or mastery-avoidance goals focused on not losing acquired skills and knowledge were similarly not available (Study 2). Shallow learning strategies such as rote memorization and rehearsal of course materials used during studying were also omitted (Study 3). Across all studies, only a single undifferentiated

value scale combining elements of both intrinsic and extrinsic value was available. This precluded a more precise analysis of the separate value components defined within CVT.

However, other critical measures such as the PAC scale, and measures of enjoyment, boredom, and anxiety were consistent across each study. Further, as each study represented a novel test of CVT's underexamined assumptions, each provides compelling initial empirical evidence in support of CVT. These supports represent valuable foundations on which to base future tests of theory by incorporating the omitted theory-derived variables noted above.

Several avenues for future research are outlined within this dissertation. First, for each study, the longitudinal timespan could be extended to several years, and with additional assessment periods. This would help to clarify whether the current findings are sustained across students' college careers, the degree to which relationships hold longitudinally, and to what extent the focal motivation and emotion variables predict outcomes such as college graduation (Hamm et al., 2020).

Further, the implications for treatment interventions described above studies could be incorporated into future methodological paradigms. For example, attribution-based motivation treatments are known to both enhance students' PAC (Dryden et al., 2022; 2023), and benefit students with low initial PAC (Parker et al., 2016; 2018). However, no study to date has examined students' academic value as an additional moderator of attribution-treatment efficacy.

Finally, although it is beyond the scope of this dissertation, the methodological paradigms featured in Study 1-3 could be integrated into a single comprehensive model. This would involve a moderated-mediation longitudinal model, ideally spanning several years, with the following repeating structure: goals-appraisals (PAC × Value)-emotions (multiple emotions, each with validated multiple-item scales)-learning strategies-achievement…graduation.

Conclusion

Each study within this dissertation focused on empirically validating an important but underexamined or overlooked assumption of CVT. Study 1 demonstrated that control and value appraisals, along with initial achievement outcomes, interact in determining students' discrete achievement emotions. Study 2 showed that achievement goals predict emotions indirectly, in part, through their influence on changes in control and value appraisals over time. Study 3 showed that appraisals predict emotions, emotions predict learning strategies, and learning strategies predict achievement, in a repeating reciprocal pattern. In short, every assumption was supported. Collectively, these studies provide strong evidence in favor of CVT, and other theories, by testing theory-derived yet novel hypotheses using a world-class database. This dissertation advances knowledge, and social psychology as a whole, by providing a strong foundation of scientific and theoretical rigor on which further research and understanding can be built.

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Appendix A

Perceived Academic Control (Studies 1-3)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

R = Item is reverse coded

The following statements concern your experiences in university and your psychology course. Although some items are similar, there are differences between them, so treat each as a separate question.

1. I have a great deal of control over my academic performance in my psychology course.
2. The more effort I put into my courses, the better I do in them.
3. No matter what I do, I can't seem to do well in my courses. **R**
4. I see myself as largely responsible for my performance throughout my college career.
5. How well I do in my courses is often "luck of the draw." **R**
6. There is little I can do about my performance in university. **R**
7. When I do poorly in a course, it's usually because I haven't given my best effort.
8. My grades are basically determined by things beyond my control and there is little I can do to change that. **R**

Appendix B

Academic Value (Studies 1 & 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The following items refer to your beliefs about your Introductory Psychology course.

1. In general, I find this course very interesting.
2. I like reading the material for this course.
3. In general, learning about the issues raised in this course is very useful for me.
4. Compared to my other activities, studying for this course is very useful for me.
5. It's very important for me to do well in this course.
6. Compared to my other activities, it is very important for me to do well in this course.

Appendix C

Course-related Enjoyment (Studies 1 & 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. I get excited about doing my work.
2. I enjoy doing my assignments
3. When my work is going well, it gives me a rush.
4. I enjoy the challenges in my work.
5. I enjoy working so much that I get invigorated.

Appendix D

Course-related Boredom (Studies 1 & 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. I get bored.
2. This course bores me to death.
3. Because I get bored, my mind begins to wander.
4. My assignments are so boring that I find myself daydreaming
5. I get so bored, I have problems staying alert

Appendix E

Course-related Anxiety (Studies 1 & 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. I get tense during my work.
2. Thinking about my work makes me feel uneasy.
3. I worry my assignments might be too difficult.
4. When I don’t understand something important, my heart races.
5. I worry I might fail.

Appendix F

Course-related Single-item Emotions (Study 1)

1	2	3	4	5	6	7	8	9	10
Not at All									**Very much So**

Using the following 10-point scale, indicate the extent to which each of the following statements describes how you feel about your experience/performance in Introductory Psychology.

1. Hopeful
2. Proud
3. Helpless
4. Ashamed
5. Regret
6. Angry

Appendix G

Course-related Mastery-approach Goals (Study 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The following statements are about your goals for your Introductory Psychology class. Please indicate your level of agreement or disagreement with each item by choosing a number from the following scale.

1. My aim is to completely master the material presented in the class.
2. My goal is to learn as much as possible.
3. I am striving to understand the content of the course as thoroughly as possible.

Appendix H

Course-related Performance-approach Goals (Study 2)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The following statements are about your goals for your Introductory Psychology class. Please indicate your level of agreement or disagreement with each item by choosing a number from the following scale.

1. I am striving to do well compared to other students.
2. My aim is to perform well relative to other students.
3. My goal is to perform better than the other students.

Appendix I

Academic Value (Study 3)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The following items refer to your beliefs about your Introductory Psychology course.

1. I like reading the material for this course.
2. I think that what we learn in my introductory psychology course is interesting
3. It is important for me to do well in my introductory psychology course.
4. The study of psychology is very important to my life.
5. I am very interested in the study of psychology in general

Appendix J

Course-related Enjoyment (Study 3)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. I enjoy learning new things.
2. Some topics are so much fun that I look forward to studying them.
3. After studying, I am pleased that I know more than before.
4. I enjoy doing my assignments.
5. Some topics are so enjoyable that I am very motivated to continue studying them.
6. Because this course is fun for me, I study the materials more extensively

Appendix K

Course-related Boredom (Study 3)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. When studying for the course, I feel bored.
2. The things I have to do for this course are often boring.
3. The content is so boring that I often find myself daydreaming.
4. When studying, my thoughts are everywhere else, except on the course material.
5. The materials in this subject area are so boring that I feel quite exhausted.
6. Often I am not motivated to invest effort in this boring course.

Appendix L

Course-related Anxiety (Study 3)

1	2	3	4	5
Strongly Disagree				**Strongly Agree**

The next set of statements also refer to your Introductory Psychology course.

1. Before I start studying material in this course, I feel tense and nervous.
2. I feel queasy when I think of having to study and to do all the work.
3. When studying for this course, I am worried that I won't be able to master all the material.
4. When studying the material for this course, my heart beats fast because I am nervous.
5. While I am studying, I sometimes would like to distract myself in order to reduce my anxiety
6. When I have problems with learning the material in this course, I get anxious.

Appendix M

Course-related Elaborative Learning (Study 3)

1	2	3	4	5	6	7	8	9	10
Not at All									**Very much So**

The items below refer specifically to your psychology course. Try to answer each item as accurately as you can.

1. When I study for this class I pull together information from different sources, such as lectures, readings, and discussions.
2. I try to relate ideas in this subject to those in other courses whenever possible.
3. When reading for this course, I try to relate the material to what I already know.
4. When I study for this course, I write brief summaries of the main ideas from the readings and my class notes.
5. I try to understand the material in this class by making connections between the readings and the concepts from the lectures.
6. I try to apply ideas from the course readings in other class activities such as lectures and discussions.