REVIEW ARTICLE

Control-Value Theory: From Achievement Emotion to a General Theory of Human Emotions

Reinhard Pekrun[1,2,3]

Abstract

In its original version, control-value theory describes and explains achievement emotions. More recently, the theory has been expanded to also explain epistemic, social, and existential emotions. In this article, I outline the development of the theory, from preliminary work in the 1980s to early versions of the theory and the recent generalized control-value theory. I provide summaries of the theory's evidence-based propositions on antecedents, outcomes, and regulation of emotions, including the fundamentally important role of control and value appraisals across different types of human emotions that are relevant to education (and beyond). The theory includes descriptive taxonomies of emotions as well as propositions explaining (a) the influence of individual factors, social environments, and socio-cultural contexts on emotions; (b) the effects of emotions on learning, performance, and health; (c) reciprocal causation linking emotions, outcomes, and antecedents; (d) ways to regulate emotions; and (e) strategies for intervention. Subsequently, I outline the relevance of the theory for educational practice, including individual and large-scale assessments of emotions; students', teachers', and parents' understanding of emotions; and change of educational practices. In conclusion, I discuss strengths of the theory, open questions, and future directions.

Keywords Control-value theory · perceived control · achievement emotion · epistemic emotion · motivation · achievement

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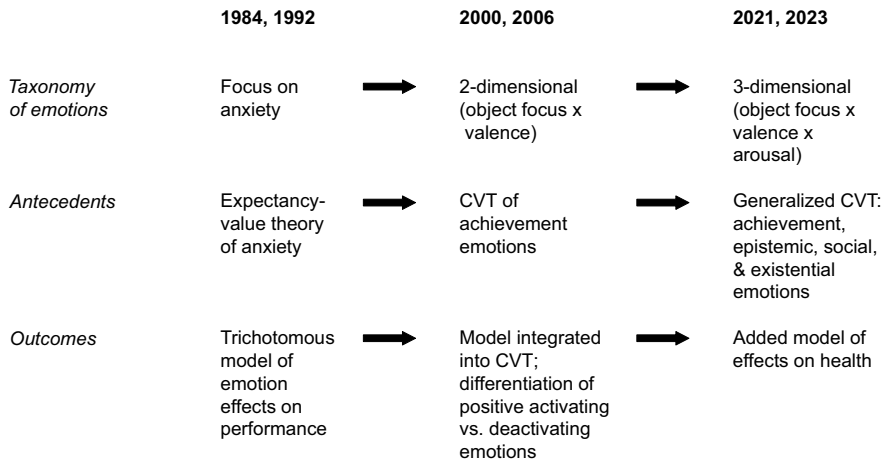
	1984, 1992		**2000, 2006**		**2021, 2023**
Taxonomy of emotions	Focus on anxiety	➡️	2-dimensional (object focus x valence)	➡️	3-dimensional (object focus x valence x arousal)
Antecedents	Expectancy-value theory of anxiety	➡️	CVT of achievement emotions	➡️	Generalized CVT: achievement, epistemic, social, & existential emotions
Outcomes	Trichotomous model of emotion effects on performance	➡️	Model integrated into CVT; differentiation of positive activating vs. deactivating emotions	➡️	Added model of effects on health

Fig. 1 Major Phases in the Development of Control-Value Theory. Note: References are Pekrun (1984, 1992a, 1992b, 2000, 2006, 2021); Pekrun et al. (2023a)

Introduction

The classroom is an emotional place. Students often experience emotions like fear, anger, shame, or boredom in educational settings, but also positive emotions like enjoyment, hope, pride, and contentment. The same is true for teachers – interacting with students can prompt intense emotions (Pekrun et al., 2002; Quinlan, 2016; William-Jones et al., 2008). Nevertheless, throughout the history of educational psychology as well as educational research more broadly, researchers have neglected the affective side of students' learning and teachers' classroom instruction. Exceptions were research on test anxiety (see Zeidner, 1998) and attributional studies (Weiner, 1985). Similarly, research in other domains involving achievement activities, such as work and sports, have not paid much attention to the emotions related to these activities.

During the past 25 years, the situation has changed. Following the affective turn in basic disciplines of psychology, economics, and neuroscience, there is an exponential growth in the number of studies investigating emotions related to achievement (for meta-analyses, see, e.g., Barroso et al., 2021; Camacho-Morles et al., 2021; Loderer et al., 2020; Stempfer et al., 2024). Control-value theory (CVT) is an integral part of this development. Following up on earlier theories of achievement emotions, including theories of test anxiety, attributional theories, and Lazarus's transactional model of stress and emotions, I developed the theory with the aim to integrate and expand upon existing evidence-based hypotheses.

By focusing on appraisals of control and value as antecedents, I intended to do this in a way that makes achievement emotion theory compatible with general appraisal theories of emotions. In addition, given the close links between emotions and motivation related to achievement, I formulated the theory such that it is compatible with expectancy-value theories of achievement motivation.

In the following, I review the development of CVT since its inception (see Fig. 1 for an overview). Such a review is lacking in the literature. I first describe the landscape of emotion and motivation theories towards the end of the twentieth century that inspired the development of the theory. I also outline preliminary work that preceded its construction as well as an early, first version of the theory (Pekrun, 2000). Next, I describe the second, more comprehensive version (Pekrun, 2006) as well as amendments made during the past 15 years. I then describe the recent generalized CVT that explains not only achievement emotions but several groups of human emotions that are relevant to education. Subsequently, I summarize implications for educational practice. In conclusion, I discuss strengths of the theory as well as open questions and future directions.

Preliminary Work and an Early Version of the Theory

In the second half of the twentieth century, psychologists developed theories of emotion and motivation that went beyond classic behaviorist conceptions and attended to the critically important role of human thought for affect and behavior. Primary examples in the motivation domain are expectancy-value theories, such as Atkinson's (1957) risk-taking model, Raynor's (1969) model of future-oriented motivation, Vroom's (1964) model of work motivation, and Heckhausen's (1977, 1980) model of achievement motivation, as well as Bandura's (1977) conception of self-efficacy. At the same time, emotion researchers developed various appraisal theories of emotion, such as Arnold's (1960) theory of appraisals and emotions, Roseman's multidimensional model of appraisals (e.g., Roseman et al., 1990) and Lazarus's transactional model of stress, appraisals, and emotions (Lazarus & Folkman, 1984; for an overview, see Scherer et al., 2001).

However, although based on the same set of basic assumptions on the importance of subjective evaluations of current situations and future prospects, these different strands of theories remained fragmented. Cross-talk was largely lacking, especially between researchers in the emotion versus motivation fields. Problems of fragmentation were aggravated by conceptual jingle-jangle fallacies (jingle: the same term used to denote different constructs; jangle: different terms used to denote the same construct; Marsh et al., 2019a, 2019b). For example, perceptions of situational demands and one's own competencies were called – and continue to be called – appraisals in emotion theories. In contrast, motivation researchers refrained from using this term and instead talked about self-concepts, expectancies, and subjective values.

Given this situation, I made three theoretical proposals in the 1980s, each of them with the aim to contribute to overcoming fragmentation (see Greene, 2022, and Pekrun, 2024, for the importance of integrating theories in our field). These proposals included a generalized expectancy-value theory of motivation, an expectancy-value theory of anxiety, and a cognitive-motivational model of the effects of emotions on learning and performance (Pekrun, 1988, 1993, 1992a, b).
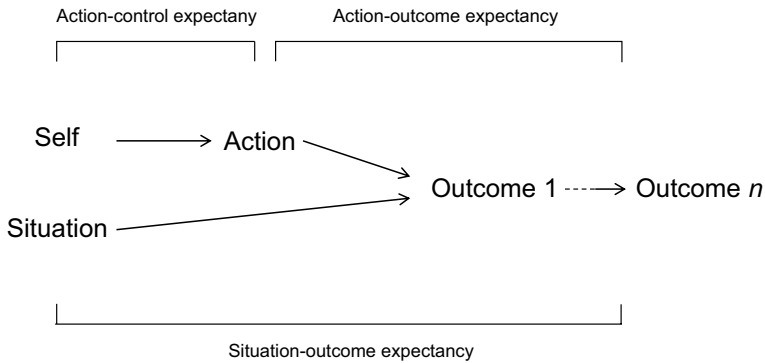
Action-control expectany   Action-outcome expectancy

Self ⟶ Action

Outcome 1 ⤑ Outcome *n*

Situation

Situation-outcome expectancy

Fig. 2 Causal Expectancies. Note: Outcome 1 and outcome *n* represent a chain of outcomes that individuals may consider when thinking about the instrumental functions of an action

Generalized Expectancy-Value Theory of Motivation

Aiming to integrate existing expectancy-value theories with Bandura's notion of self-efficacy, I developed a generalized expectancy-value theory of motivation (GEXVAM; Pekrun, 1983, 1988, 1993). The concepts used in this theory subsequently also served as building blocks in developing control-value theory. For expectancies, the theory used the following concepts (see Fig. 2): (1) Action-control expectancy, defined as expectancy to be able to initiate and perform a given action; (2) action-outcome expectancies that the action generates outcomes; and (3) situation-outcome expectancies that situational forces will generate outcomes. Action-control expectancy is related to Bandura's notion of self-efficacy expectation, but is broader because it does not narrow the concept down to *successful* execution of an action (Bandura, 1977, p. 193). The overall expectancy that an outcome will occur is thought to be a joint function of the three types of expectancies: An outcome is expected if the situation generates the outcome, or if one feels able to perform an action that will produce it.

In terms of value, the theory distinguishes between intrinsic and extrinsic values of actions and outcomes. Additionally, it is argued that both types of values can be positive or negative, thus yielding a $2 \times 2 \times 2$ conception of value (Table 1). Intrinsic positive value implies that an action or outcome is desirable for its own sake. For example, an action is intrinsically valuable when it is performed because it is interesting, such as studying being valuable when one is interested in the subject. Similarly, an outcome is intrinsically valuable if it is desirable regardless of further outcomes, such as success at a competition being valuable for its own sake in people who are competitively motivated, regardless of subsequent praise or financial gratification. Extrinsic positive value of an action means that the action is desirable because it leads to valuable outcomes, and outcomes have extrinsic positive value if they lead to further valued outcomes, such as good grades at school opening up job opportunities.

Table 1 Types of Values: Examples

	Activity value		Outcome value	
	Intrinsic	*Extrinsic*	*Intrinsic*	*Extrinsic*
Positive	Pleasure, interest, flow, congruency with norms & identity	Expectation of positive outcomes	Pleasure; congruency with norms & identity	Expectation of further positive outcomes
Negative	Displeasure, aversion, lack of flow, lack of congruency with norms & identity	Expectation of negative outcomes, including costs (loss of time, money, opportunities)	Displeasure; lack of congruency with norms & identity	Expectation of further negative outcomes

Negative values imply that the action or outcome is undesirable (i.e., that it is desirable not to perform the action or to avoid the outcome). For example, studying can have negative intrinsic value when it requires effort that is experienced as aversive. Similarly, poor achievement outcomes can be experienced as negative even when they do not lead to further negative consequences, thus having negative intrinsic value. Negative extrinsic value refers to negative consequences, such as criminal behavior leading to penalties. This conception of negative value is equivalent to usage of the term in economics to denote losses, costs, and debts (e.g., Kahneman & Tversky, 1979). It includes the immediate costs of actions as considered in Eccles and Wigfield's expectancy-value theory (e.g., Eccles & Wigfield, 2020).

Based on these concepts, GEXVAM explains both intrinsic and extrinsic motivation, in contrast to traditional expectancy-value theories that focused on motivation to attain goals and outcomes. Intrinsic motivation to perform an action is thought to be a joint function of action-control expectancy and the intrinsic value of the activity. For example, students will be intrinsically motivated to learn if they feel competent and are interested in the material. Extrinsic motivation is a joint function of the expectancy to attain action-contingent outcomes and the value of these outcomes. For example, if exercise is experienced as unpleasant, motivation to exercise may nevertheless be high if exercise is thought to preserve health and health is highly valued.

Expectancy-Value Theory of Anxiety

In the last decades of the twentieth century, research on emotions in achievement contexts, and in psychology more generally, has largely focused on negative emotions like anxiety. Theories of anxiety have considered expectations of threatening events as prime causes of this emotion (see Beck & Clark, 1988; Lazarus & Folkman, 1966; Price et al., 1985; Zeidner, 1998). For example, Lazarus and Folkman (1984) proposed that negative emotions generated by stressful events are based on two appraisals: a primary appraisal of the threat posed by the event, and a secondary appraisal of one's ability to cope with the threat. Anxiety was thought to be caused by the combination of expected threat and lack of resources to cope with it.

Interpretations of anxiety as being generated by threatening events imply that anxiety depends on (a) the expectancy of the event and (b) its perceived value (or importance). To make these two assumptions more precise and formalize them, I developed the expectancy-value theory of anxiety (EVTA; Pekrun, 1984, 1988, 1992a). This theory uses expectancy-value terminology from GEXVAM to conceptualize the appraisals generating anxiety related to future events, thus making anxiety theory compatible with expectancy-value theories of motivation. More specifically, the theory proposes that anxiety is generated by expectancies of future events that are perceived as having negative value, such as failure on an upcoming exam (for evidence documenting the role of negative value for anxiety, see Pekrun et al., 2023a). The expectancy of a negative event is proposed to be a function of situation-outcome, action-control, and action-outcome expectancies related to the event. The event is perceived as likely when high situation-outcome expectancy is combined with low action-control and/or action-outcome expectancies for preventive actions. For example, when I believe that my financial situation will end in a disaster if I do not act, but I cannot perform suitable actions or any possible actions would not reduce my debts, then personal bankruptcy seems likely.

The intensity of anxiety is proposed to be a multiplicative function of the overall expectancy of the event (i.e., its subjective likelihood) and its negative value. If the likelihood of the event is zero, or if the event is not relevant, then no cognitively mediated anxiety is prompted. For example, if a student is certain to succeed on an exam, or does not care about it, then anxiety will remain low. It is the toxic combination of lack of confidence and high importance that causes anxiety. However, there may be limits to the impact of expectancy on anxiety. The theory proposes that anxiety is a non-monotonic, curvilinear function of likelihood: Up to some level, the intensity of anxiety increases with increasing likelihood. Beyond that level, when the likelihood approaches 1.0 and the event seems certain and unavoidable, anxiety is expected to be replaced by hopelessness. As such, anxiety is thought to be a function of uncertainty rather than just negative expectancy.

In addition, EVTA includes propositions on the role of social environments for the development of anxiety, based on their impact on expectancies and values. Environments that produce negative events that are not well predictable can prompt negative situation-outcome expectancies and uncertainty, such as times of war and economic crisis, but also educational settings that provide failure feedback and lack transparency. Similarly, demanding environments that exceed personal resources and reduce positive expectancies can lead to intense anxiety, such as overly competitive learning environments in education. In addition, environmental factors that increase the importance of possible negative events are thought to prompt anxiety, such as high-stakes testing that reduces students' educational opportunities as a consequence of academic failures. Expanded versions of these propositions were subsequently integrated into CVT (see below).

Cognitive-Motivational Model of Emotion Effects

Appraisal models like EVTA explain antecedents of emotions but do not consider their effects on motivation and performance. In a cognitive-motivational model of these effects (Pekrun, 1992b), I argued that is not sufficient to only consider the valence dimension of emotions (positive vs. negative) to understand their effects, as it had been done in most experimental mood and emotion studies at the time. Rather, it is imperative to take arousal into account as well. Second, I argued that it is insufficient to only consider single mechanisms, such as effects of emotion on motivation, working memory, or modes of thinking, to understand effects on task performance. Rather, it is the interplay of different mechanisms that determines overall effects on performance.

The model had a trichotomous format by distinguishing three groups of emotions: positive (e.g., enjoyment of learning); negative activating (e.g., anger, anxiety); and negative deactivating (e.g., boredom, hopelessness). Effects of these groups of emotions on learning and performance were hypothesized to be mediated by effects on working memory resources; intrinsic and extrinsic task motivation; and styles of processing, storing, and retrieving information. Later this model also became part of CVT.

The Early (2000) Version of Control-Value Theory

The expectancy-value paradigm that I used in EVTA is only in part suited to explain human emotions. Expectancies refer to future events; they involve cognitive representations of prospective temporal relations. As such, they can prompt prospective, future-oriented emotions, such as anxiety related to possible failure on an upcoming exam. They do not explain retrospective emotions related to past events, like a poor grade on a past exam. They are also not suited to explain emotions related to current, ongoing activities, such as boredom during studying. Retrospective emotions can be explained by subjective evaluations of past events, such as causal explanations of these events as targeted in attributional theories of emotions (e.g., Weiner, 1985). Concurrent emotions depend on evaluations of the current activity, such as perceptions of one's competence to perform the activity.

In the first version of CVT (Pekrun, 2000), I built on the explanations of achievement anxiety provided by EVTA and expanded them in two ways. First, the theory considered a broader range of prospective achievement emotions, including hope, anticipatory joy, anxiety, and hopelessness related to future success and failure, respectively. These emotions were thought to result from expectancies of these outcomes. Second, the theory integrated propositions on retrospective and concurrent achievement emotions. It was posited that recollections and causal attributions of past success and failure prompt retrospective emotions (e.g., pride, shame), and that current competence perceptions trigger emotions related to ongoing achievement activities (e.g., enjoyment, boredom). Perceptions of value were thought to be critically important for all three groups of emotions.

Central to this synthesis is an integrative conception of causal cognitions including prospective causal expectancies, retrospective causal attributions, and current competence perceptions. All three types of cognitions are defined by cognitive representations of causal relations. Causal expectancies refer to prospective causal relations between situation and outcome (situation-outcome expectancies), self and action (action-control expectancies), and action and outcome (action-outcome expectancies). Causal attributions refer to the same causal relations, but in a retrospective fashion – actions and outcomes being explained either by one's own intentions (internal attributions) or by situational forces (external attributions). Competence perceptions pertain to competencies as causal conditions for the performance of actions.

A convenient umbrella term for these different causal relations is the term "control." The term has been used in different ways (see, e.g., Skinner, 1996). However, different usages of the term have a common denominator: Control of A over B implies that A has a causal influence on B. As such, prospective and retrospective cognitive representations of causal linkages between situations, intentions, actions, and outcomes are representations of control. For the CVT propositions on prospective achievement emotions, an adequate alternative label would be "expectancy-value theory of achievement emotions." For the whole set of propositions about all three types of emotions, this label would be misleading – which is why I coined the term "control-value theory" to denote the whole theory.

In addition, following up on EVTA, the 2000 version of the theory considered the impact of social environments and the broader socio-cultural context on achievement emotions. Factors addressed included the quality of classroom instruction and macrosystem features like cultural values. Finally, the early version of the theory also acknowledged that achievement emotions can reciprocally influence the environment, an idea that was more fully developed in the second, full-blown version of the CVT of achievement emotions to be described next.

Control-Value Theory of Achievement Emotions

Since its inception, CVT has been gradually expanded and refined to more fully represent a broad range of achievement emotions and address their antecedents, their impact on performance and health, their development, and their regulation and related intervention. Many of these amendments have been published in the 2006 article in this journal that described the theory (Pekrun, 2006). Since then, further stepwise amendments have been made. Some of these amendments were prompted by discrepancies between original propositions and empirical evidence, similar to the development of cognitive load theory described by Sweller (2023). An example is the link between perceived control and anger (see below). In the following, I provide an overview of the current state of the theory.

Concept and Taxonomy of Achievement Emotions

CVT defines achievement emotions as emotions related to achievement activities or achievement outcomes, that is, activities and outcomes that are judged according to competence-based standards of quality. Accordingly, two broad groups of these emotions can be distinguished: activity emotions and outcome emotions. The distinction between these two groups pertains to their *object focus*. In addition to type of object (activity vs. outcome), object focus involves temporal relations between person and object – the object of an emotion can be located in the present, the future, or the past. This is true both for activities (e.g., enjoying a current activity, looking forward to a future activity, or enjoying recollections of past activities) and for outcomes (Pekrun et al., 2023a). In achievement settings, three of the six possible combinations of type of object and temporal relation may be most important: concurrent activity emotions such as enjoyment or boredom during learning; prospective outcome emotions like hope and anxiety; and retrospective outcome emotions like pride and shame.

In addition to object focus, achievement emotions can be grouped according to valence and physiological arousal, similar to emotions more generally. In terms of valence, positive (pleasant) emotions (e.g., enjoyment) can be distinguished from negative (unpleasant) emotions (e.g., anxiety). In terms of arousal, activating emotions (e.g., anger) can be distinguished from deactivating emotions (e.g., boredom). Object focus, valence, and arousal are conceptually independent. In recent work, we developed a taxonomy of achievement emotions that combines all three dimensions (Pekrun et al., 2023a; see Table 2). This taxonomy is thought to fully cover the conceptual space of these emotions. It also made it possible to conceptualize emotions that had not yet been considered in the literature, such as assurance, defined as a prospective, relaxed affective state that involves subjective certainty about future success. Assurance is different from hope which is also a positive emotion, but characterized by uncertainty. In addition to degree of certainty, assurance and hope differ in terms of physiological arousal. In contrast to hope that involves the physiological arousal coming with uncertainty, assurance is thought to be characterized by physiological deactivation (for a more detailed description of this construct and differences to other emotions, see Pekrun et al., 2023a).

The three-dimensional taxonomy has implications not only for describing achievement emotions, but also for explaining them. Any more comprehensive explanatory account needs to consider the full range of these emotions. In addition, the taxonomy has consequences for measurement. To capture a range of achievement emotions, we have developed the Achievement Emotions Questionnaire (AEQ). The original version of this instrument considered various achievement emotions (Pekrun et al., 2011), but failed to cover all cells of the taxonomy. As such, we developed a revised version to more fully capture this conception (AEQ-R; Pekrun et al., 2023a).

Table 2 Three-Dimensional Taxonomy of Emotions: Examples

Object Focus	Positive [a]		Negative [b]	
	Activating	Deactivating	Activating	Deactivating
Achievement				
Activity	Enjoyment Excitement	Relaxation	Anger Frustration	Boredom
Outcome/ prospective	Hope Anticipatory joy	Assurance	Anxiety	Hopelessness
Outcome/ retrospective	Pride Retrospective joy Gratitude	Contentment Relief	Shame Anger	Sadness Disappointment
Epistemic				
Incongruity of information	Surprise [c] Curiosity [d] Delight	Contentment	Confusion Frustration	Boredom
Social				
Self-related	Pride	Satisfaction (with self)	Shame Guilt	Dissatisfaction (with self)
Other-related	Love Gratitude Admiration Compassion	Sympathy	Hate Anger Contempt Envy	Antipathy
Existential				
Health, life, disease, death	Happiness (health)	Relief (recovery)	Anxiety (disease, death)	Hopelessness (disease, death)

[a] Positive = pleasant emotion. [b] Negative = unpleasant emotion. [c] Alternatively, surprise can be neutral or negative (Pekrun et al., 2017b). [d] Alternatively, curiosity has been described as unpleasant

Appraisal Antecedents: Perceptions of Control and Value

The links between control-value appraisals and achievement emotions are at the core of CVT. The theory acknowledges that there are various mechanisms that can generate emotions or influence them, such as genetic dispositions, neurohormonal processes, and sensory perceptions. It is acknowledged that some types of emotions are based on biologically prepared emotion schemata rather than being mediated by cognitive appraisals (e.g., fear of heights). However, emotions in settings that are a product of cultural evolution are thought to depend on adaptive interpretations of the situation and one's own competencies to manage the situation. Achievement settings in today's world, such as school, university, and the workplace, are recent products of civilization. As such, the emotions related to activities and outcomes in these settings are thought to be cognitively mediated.

From its inception (Pekrun, 2000), CVT uses the above-mentioned concepts of control and value to explain achievement emotions. The theory posits that achievement emotions depend on the interplay of perceived control and perceived value. Succinctly stated, achievement emotions are thought to be prompted when feeling in control over, or out of control of, important achievement activities and their outcomes.

More specifically, activity emotions depend on current competence appraisals and the perceived value of the activity. Sufficient competence and value make it possible to enjoy the activity, in addition to promoting motivation as noted earlier. For example, students who perceive they can master learning tasks and are interested in the material can enjoy studying. In contrast, anger is thought to be aroused by a lack of control due to obstacles that cannot be managed, combined with high value. Finally, boredom is hypothesized to be prompted by lack of value, as in monotonous activities that lack challenge and interesting contents. When value is lacking, boredom can occur both when control is high relative to task demands, implying underchallenge, and when it is low, implying overchallenge (Pekrun & Goetz, 2024a).

To explain, in the 2006 version of the theory, activity-related anger was thought to be a positive function of control (Pekrun, 2006). However, empirical findings did not support this hypothesis. Rather, associations between perceived control and students' learning-related anger turned out to be consistently negative (e.g., Pekrun et al., 2011). Accordingly, the proposition has been dropped in subsequent publications on the theory (Pekrun, 2018; Pekrun & Perry, 2014), leaving the relation between control and anger as an open question. More recently, my colleagues and I checked the empirical evidence that had accumulated over the years. As a consequence, we replaced the original hypothesis by the proposition that anger during achievement activities is negatively related to control (Forsblom et al., 2022). As noted in the Forsblom et al. (2022) article, it seems reasonable to assume that high control makes it possible to change achievement activities and make them less aversive, suggesting that anger is promoted by low rather than high levels of perceived control. For example, when uncontrollable obstacles are encountered that hinder task completion, such as a traffic congestion that leads to missing a lecture at university, or computer problems interrupting one's work, then intense anger can arise.

Prospective outcome emotions related to future success and failure are prompted by high control or lack of control, respectively, combined with high value of these achievement outcomes. More specifically, hope and anxiety are most intense when the outcome is not certain. An attentional focus on possible success triggers hope; an attentional focus on possible failure triggers anxiety. Since attentional focus can shift, uncertainty can prompt oscillations between these two emotions. In contrast, subjectively certain success leads to anticipatory joy and assurance, and subjectively certain failure (or non-attainment of success) leads to hopelessness.

Retrospective outcome emotions are generated by recollections of past success and failure, combined with their perceived value (to explain, "past" as conceptualized in CVT does not need to be the distant past, it can be just a few seconds ago). The intensity of control-independent joy, sadness, and frustration only depends on

the perceived value of the outcome. Following up on Weiner's (1985) attributional theory, emotions like pride, shame, gratitude, and anger about failure are thought to additionally depend on causal attributions of the outcome to internal versus external factors (but see Pekrun, 2006, for differences between CVT and Weiner's propositions).

The extant evidence supports these hypotheses (for summaries, see Pekrun & Perry, 2014; Pekrun et al., 2023a). Early studies focused on links between global control-value constructs and achievement emotions. More recently, we refined the design of studies in three ways. First, whereas early studies have used summary measures of value, in current studies we differentiate between the value of achievement activities and the value of outcomes, and between the positive value of success and the negative value of failure, which makes it possible to examine specific relations between different types of values and different emotions as hypothesized (e.g., Pekrun et al., 2023a). Second, we have started to test the proposed interactions between control and value appraisals (see, e.g., Putwain et al., 2018; Shao et al., 2020). The findings confirm that achievement emotions are boosted by combinations of control (or lack thereof) and value. Finally, beyond correlational evidence, studies use causal designs to investigate the impact of appraisals on achievement emotions as well as reciprocal effects of these emotions on appraisals (Forsblom et al., 2022; Pekrun et al., 2023a).

Implications: Domain Specificity of Achievement Emotions

Traditionally, achievement emotions have been conceptualized as domain-general constructs. For example, students' test anxiety was considered a trait-like variable, implying that test anxious students are generally prone to be anxious in evaluative situations. CVT offers a different perspective. To the extent that control and value appraisals differ across domains, it follows from CVT that achievement emotions are domain-specific as well. Variables related to perceived control and value, such as students' academic self-concepts and interests, are known to be organized in largely domain-specific ways. Beyond the elementary school age, self-concepts typically show zero correlations across non-similar (e.g., math vs. verbal) domains (Wan et al., 2021), and students' interest also varies widely across subjects. As such, emotions should differ as well.

After recognizing this implication, we conducted studies testing the domain specificity of achievement emotions. The resulting findings support this corollary of CVT (e.g., Goetz et al., 2007). Correlations between emotions like enjoyment of learning or anxiety across the math and language domains tend to be close to zero as well, with increasing differentiation as a function of age. For assessment, this finding implies that measures of achievement emotions should attend to their situated, domain-specific nature. For educational practitioners, it is important to know that they cannot infer from a student's enjoyment or anxiety in a given subject that the student feels the same way across all academic subjects. Rather, it is imperative to attend to the domain-related specificity of their emotions.

Implications: Individual Antecedents

CVT considers control-value appraisals as immediate antecedents of achievement emotions. By implication, individual factors that influence these appraisals should also impact the resulting emotions. Appraisals should function as mediators in the relation between these factors and emotions. Important individual variables addressed in CVT are individual performance, achievement goals, beliefs about achievement (such as growth mindset), and stereotypes about competencies and interests linked to gender, race, and social class.

For achievement, it follows from the theory that success strengthens perceived control, whereas failure undermines control. By implication, success should promote the positive emotions resulting from control, and failure should boost the negative emotions prompted by lack of control. Longitudinal evidence supports these hypotheses (e.g., Forsblom et al., 2022; Jirout et al., 2023; Pekrun, 1992a; Pekrun et al., 2017a, 2023b). For achievement goals, Elliot and I used achievement goal theory and CVT to derive a joint model explaining the impact of these goals on emotions (Pekrun et al., 2006, 2009). The model suggests that mastery-approach goals focus attention on one's competence and the positive value of achievement activities, whereas performance-approach and performance-avoidance goals focus attention on the controllability (or lack thereof) and importance of success and failure outcomes, respectively. The empirical evidence confirms the resulting links between goals and emotions (see Huang, 2011; Pekrun et al., 2006, 2009).

Further corroborating the role of control-value appraisals, gender-linked beliefs, such as female versus male students' beliefs about their competencies in mathematics, have been shown to explain gender differences in achievement emotions (see, e.g., Frenzel et al., 2007; Goetz et al., 2013). Similarly, it follows from CVT that differences in emotions that are linked to individuals' ethnic, cultural, and socioeconomic background should be mediated by beliefs about control and value.

Implications: Social Antecedents

Similar to the influence of individual antecedents, social factors that impact control-value appraisals should also influence the emotions resulting from these appraisals (see Fig. 3). Important factors considered in CVT include the following.

(1) The *cognitive quality* of achievement environments, such as the learning environment in the classroom, influences the acquisition of competencies, the competent performance of achievement activities, and resulting control perceptions (e.g., Pekrun et al., 2023a). By fulfilling needs for competence (Ryan & Deci, 2017), high-quality environments can also boost value. A critically important variable is the difficulty level of tasks. If tasks are too demanding, lack of control and negative emotions can result. If tasks are too easy, they may not be enjoyable either, and boredom can result instead.

(2) The *emotional and motivational quality* of environments impacts value appraisals, thus influencing achievement emotions. Value induction can take both direct and indirect forms. Direct induction includes verbal messages about the
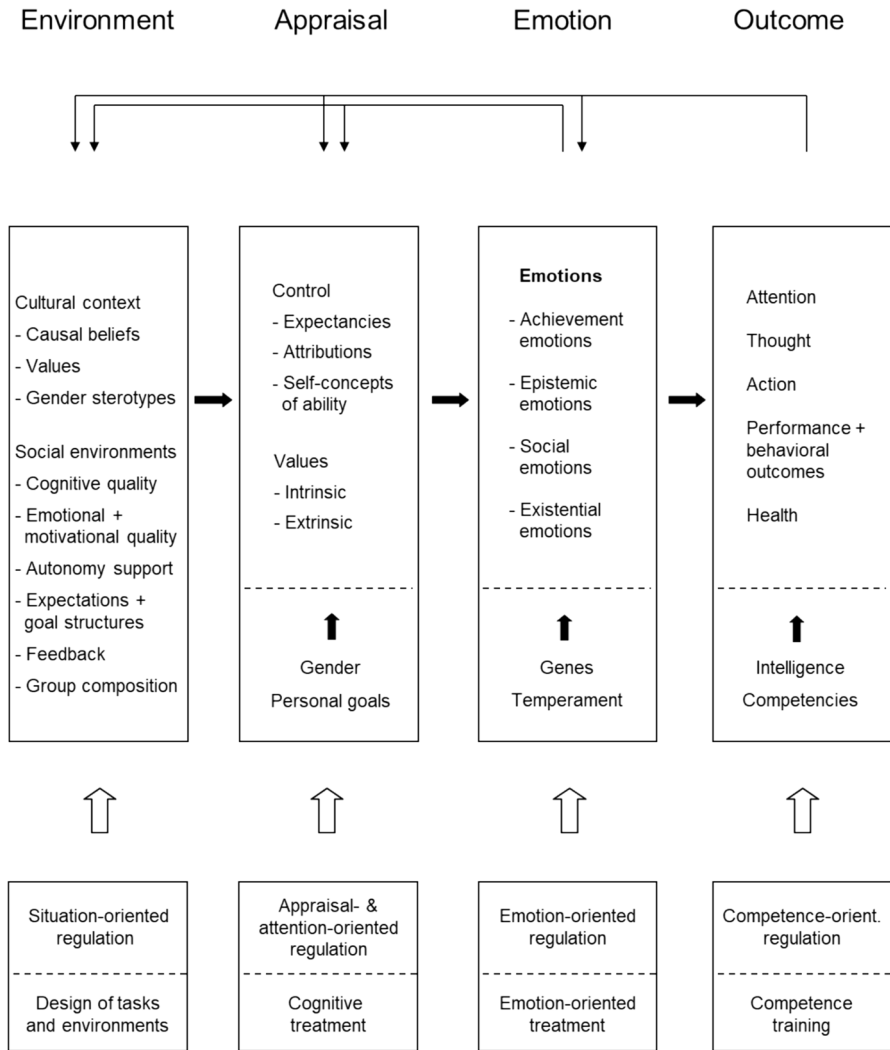
Environment	Appraisal	Emotion	Outcome

Cultural context
- Causal beliefs
- Values
- Gender sterotypes

Social environments
- Cognitive quality
- Emotional + motivational quality
- Autonomy support
- Expectations + goal structures
- Feedback
- Group composition

Control
- Expectancies
- Attributions
- Self-concepts of ability

Values
- Intrinsic
- Extrinsic

Gender
Personal goals

Emotions
- Achievement emotions
- Epistemic emotions
- Social emotions
- Existential emotions

Genes
Temperament

Attention

Thought

Action

Performance + behavioral outcomes

Health

Intelligence
Competencies

Situation-oriented regulation

Design of tasks and environments

Appraisal- & attention-oriented regulation

Cognitive treatment

Emotion-oriented regulation

Emotion-oriented treatment

Competence-orient. regulation

Competence training

Fig. 3 Control-Value Theory: Basic Propositions

importance of achievement; indirect induction consists of nonverbal messages. A prime example for indirect induction is transmission of the emotions displayed by others, such as teachers' enthusiasm during instruction supporting students' enjoyment of learning (e.g., Frenzel et al., 2018, 2024).

(3) *Autonomy support* can influence both control and value. Providing choice between tasks and strategies to perform tasks is thought to promote competence and fulfill needs for autonomy, thus boosting control, positive value, and the resulting positive emotions (see, e.g., Cui et al., 2017). Sufficient competencies to self-regulate achievement activities are needed for these positive effects to occur.

(4) *Social expectations*, *goal structures*, and *social interaction* define opportunities to experience success and fulfill needs for relatedness. If expectations of significant others, such as teachers and parents, are too high, then success may seem unattainable, thus, generating anxiety and hopelessness (see also Murayama et al., 2016). Similarly, competitive goal structures may undermine perceptions of control. In contrast, well-calibrated cooperative structures can promote a sense of control and, at the same time, promote value by meeting needs for relatedness.

(5) *Feedback* about achievement shapes perceptions of control (Forsblom et al., 2022), and the *consequences* of achievement (financial gratifications, career opportunities etc.) influence perceptions of (extrinsic) value. From CVT propositions, it follows that high-stakes testing can boost the perceived importance of achievement to the extent that excessive anxiety and hopelessness are generated in many students and teachers.

(6) It follows from CVT that the *composition of groups* also plays an important role. In a recent model of compositional effects on emotions, Marsh and I combined CVT propositions with hypotheses from his big-fish-little-pond effect (BFLPE) model. We hypothesized, and found empirically, that being a member of a group of high achievers reduces self-confidence and perceived control, thereby decreasing positive achievement emotions and exacerbating negative emotions ("happy-fish-little-pond effect"; Pekrun et al., 2019; for a generalization across countries, see Basarkod et al., 2023).

Beyond immediate social environments (microsystems in Bronfenbrenner's, 1979, socio-ecological model), CVT proposes that institutions and the broader socio-cultural context (macrosystem) impact appraisals and, therefore, achievement emotions (see Pekrun, 2018, for a discussion of evidence). The impact of institutional and context factors can be indirect, by shaping immediate achievement environments. However, some of these factors can also directly impact individual appraisals and emotions. Prime examples are shared achievement values and gender- and race-linked collective stereotypes about competencies.

Effects on Learning, Achievement, and Health

Beyond antecedents, CVT also explains effects of achievement emotions. In the 2006 version of the theory, I included and expanded propositions of the above-mentioned cognitive-motivational model of emotion effects (Pekrun, 2006; Pekrun & Linnenbrink-Garcia, 2022). More recently, we added propositions on the role of achievement emotions for mental and physical health (Pekrun & Loderer, 2020; Pekrun et al., 2023a).

Learning and Achievement As noted, the original cognitive-motivational effects model (Pekrun, 1992b) considered three groups of emotions (positive, negative activating, negative deactivating). This approach was consistent with paradigms in experimental mood research in the 1970s and 1980s that distinguished between positive and negative emotions, and sometimes between activating and deactivating negative emotions, but rarely between different types of positive emotions. Discussions

with colleagues alerted me to the fact that this model had two limitations: It did not differentiate between positive activating emotions (e.g., excitement, pride) and positive deactivating emotions (e.g., relief, relaxation), and it did not address the role of object focus. In the 2006 and subsequent versions of the model, differences between activating and deactivating positive emotions and the importance of object focus are addressed (Pekrun, 2006; Pekrun et al., 2023a).

Due to their positive effects on working memory, motivation, flexible thinking, and self-regulation. *positive activating* emotions are thought to have positive effects on performance under most task conditions. These effects are supposed to be especially pronounced when the focus of the emotion is on the task (e.g., enjoyment of learning) rather than other objects (e.g., being proud of an award, which can distract attention). The effects of *negative deactivating* emotions (boredom, hopelessness) are thought to be generally detrimental. In contrast, the effects of *positive deactivating* and *negative activating* emotions are expected to be more complex. For example, anxiety (negative activating) is known to generate task-irrelevant thinking such as worries about possible failure, and it undermines intrinsic motivation. On the other hand, anxiety can prompt strong extrinsic motivation to avoid failure by investing effort, and it can facilitate more rigid and analytical models of thinking, thus making it more difficult to predict effects on overall achievement.

The extant evidence confirms the resulting links between achievement emotions and achievement in education, work, and sports. For education, several meta-analyses document significantly negative relations between test anxiety and math anxiety, on the one hand, and students' achievement, on the other (e.g., Barroso et al., 2021; von der Embse et al., 2018). In three meta-analyses of emotions beyond anxiety, we found that emotions other than anxiety also correlate substantially with academic achievement (Camacho-Morles et al., 2021; Loderer et al., 2020; Stempfer et al., 2024). Furthermore, longitudinal research suggests that these relations are in fact due to effects of emotions on achievement, in addition to reciprocal effects of achievement on the development of emotions (e.g., Forsblom et al., 2022; Pekrun et al., 2017a; Steinmayr et al., 2016).

In a recent analysis using the random-intercept cross-lagged panel model, we found that these reciprocal links can also be confirmed on a within-person level (Pekrun et al., 2023b). Interestingly, this analysis yielded correlations of the time-invariant random intercepts for emotions and achievement that were substantially higher (median coefficient: $|r| = .468$) than correlations in previous research that did not decompose between- and within-person variance. Pending replication, this finding suggests that the strength of the emotion-achievement link may have been underestimated in previous research. Among different emotions, the future-oriented emotions of hope and hopelessness turned out to be especially predictive, and more predictive than anxiety that was the focus in the majority of studies to date (see Pekrun et al., 2023a).

Mental and Physical Health Given the ubiquity of achievement situations across the life span, the emotions occurring in these situations can be considered part of

people's mental health and psychological wellbeing. In the same vein, excessive negative achievement emotions, such as excessive test anxiety or boredom, could be considered mental disorders (see Pekrun & Loderer, 2020). Nevertheless, achievement emotions are not considered in current classifications of disorders, such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 and the World Health Organization's International Classification of Diseases (ICD) 11. CVT and the extant evidence suggest that excessive negative achievement emotions can be long-lasting, and that they can severely undermine everyday functioning and wellbeing. We have therefore called for re-considering excessive negative achievement emotions as mental disorders (test anxiety was included in the ICD 10 but was subsequently dropped; Pekrun & Loderer, 2020).

In addition, achievement emotions can impact physical health. In a recent amendment of CVT (Pekrun et al., 2023a), we have proposed that especially low-control negative emotions, such as anxiety, shame, and hopelessness, can reduce health by impairing mechanisms needed to manage stress and preserve health (leading, e.g., to reduced immune system functioning; neurohormonal processes such as long-term excretion of cortisol; sleep problems). Empirically, we found that these low-control emotions were in fact predictive of students' self-reported psychosomatic health problems.

Reciprocal Causation, Emotion Regulation, and Intervention

EVTA included the proposition that anxiety and achievement are linked by reciprocal causation: Anxiety impairs achievement, and failure prompts anxiety of failing again (Pekrun, 1992a). By acknowledging reciprocal causation, this view overcomes the limitations of previous unidirectional models stating that anxiety-achievement relations are either due to effects of anxiety on achievement (interference model), or to effects of lack of competencies and achievement on anxiety (deficit model; see Zeidner, 1998).

CVT incorporates this proposition and expands it in two ways (Fig. 3). First, CVT posits that all achievement emotions can be reciprocally linked to achievement over time. Emotions impact achievement outcomes, and these outcomes, in turn, prompt emotions and shape their development. Second, emotions can impact on their individual and social antecedents. As such, emotions and antecedents are also linked by reciprocal causation. For example, emotions can facilitate the activation of like-valenced memories, implying that positive emotions can prompt positive control and value appraisals, and negative emotions perceptions of lack of control and negative value (see Pekrun et al., 2023a). Similarly, the emotional climate in the classroom can impact students' emotions, and these emotions, in turn, impact the climate. For example, teachers' and students' enjoyment can be linked by the resulting reciprocal effects (Frenzel et al., 2018, 2024).

The dynamics of reciprocal effects implies that emotions can be regulated by targeting any of the elements in the resulting cyclic feedback processes. Accordingly, CVT proposes that strategies to regulate achievement emotions can be classified into

five major groups. First, emotions can be managed by directly enhancing or suppressing their component processes, such as enhancing or suppressing the expression of emotion (*emotion-oriented regulation*). A second option is to select or modify situations in a way that changes emotions, such as selecting a school that better fits a student's needs, or selecting tasks that match a student's competencies (*situation-oriented regulation*). Third, achievement emotions can be managed by changing one's appraisals (*appraisal-oriented regulation*) or by refocusing attention towards or away from emotional stimuli, such as success and failure (*attention-oriented regulation*). Finally, achievement emotions can be regulated by increasing one's competencies, thus increasing the likelihood of success and strengthening the resulting positive emotions (*competence-oriented regulation*). Interventions targeting achievement emotions can be grouped in the same way (see Fig. 3).

This classification is conceptually equivalent with Gross's model of emotion regulation (see Gross, 2015; Harley et al., 2019), but extends it in an important way: CVT considers competence-oriented regulation as a prime strategy to manage emotions. Competence development plays a role in the management of various types of emotions. However, it may be especially important for regulating emotions in achievement settings, given that these emotions are prompted by competence-contingent success and failure.

Relative Universality of Achievement Emotions

All things being equal, parsimonious theories are more useful than complex ones. From this perspective, explaining phenomena by use of universal, generalizable laws should be preferable to local theories that only apply to a limited number of phenomena in specific institutional or sociocultural contexts. However, while universal laws offer the advantage of explaining many phenomena (provided they are valid), it may be the case that they do not describe any of these phenomena in sufficient depth. As such, there can be a trade-off between parsimony and depth of explanation. Furthermore, there may be phenomena for which universal laws do not apply at all. Accordingly, where should theories of emotions be located on the continuum from universal (or nomothetic or etic) to local (or idiographic or emic)?

CVT's answer is that principles of "relative universality" hold. The specific, individual objects of achievement emotions, their intensity, their frequency, and their duration are expected to vary across persons and contexts. In contrast, the basic functional mechanisms linking achievement emotions with outcomes and antecedents are thought to be universal (see Pekrun, 2018, and Pekrun & Goetz, 2024b). This is not a unique position – other theories of psychological processes hold a similar view (see, e.g., Vansteenkiste et al., 2020, for self-determination theory, and Marsh et al., 2019a, 2019b, for self-concept theory).

Empirical evidence supports this position (for reviews, see Pekrun, 2009, 2018; Pekrun & Goetz, 2024b). For example, achievement emotions have been found to vary widely across individual students and teachers, genders, academic domains, and cultural contexts. Nevertheless, their links with control-value appraisals and academic achievement are largely equivalent across genders, domains, and

countries. For example, across cycles of the OECD's Programme for International Student Assessment (PISA), relations between students' enjoyment (such as science enjoyment) or anxiety (such as math anxiety) were similar across the broad range of countries included (see Guo et al., 2022; OECD, 2013). As such, the extant evidence suggests that CVT propositions are universally applicable.

Generalized Control-Value Theory

Beyond achievement emotions, affective science considers various other types of human emotions (e.g., epistemic emotions, social emotions) that are critically important for education. Similar to research in related fields (e.g., motivation; Pekrun, 2024), research on these different groups of emotions is characterized by a proliferation of constructs and theories that target the same or similar phenomena but remain in siloed territories. The resulting multiplicity and redundancy of concepts hinders communication not only among scientists, but also with educational practitioners, policymakers, and the public (see also Gigerenzer, 2017; Greene., 2022).

How can we achieve better integration of achievement emotion research with studies addressing other emotions relevant to education? When reflecting upon common denominators of theories addressing different groups of emotions, and shared origins of these emotions, I noticed that appraisals related to control and value play a major role in (almost) all of them. For emotions beyond the achievement emotion domain, appraisals other than control and value play a role as well, but control and value are critically important for all of them. In other words, perceptions of control and value are likely to be prime determinants not only for emotions in achievement settings, but also for emotions in other situations.

Based on this premise, I developed a set of propositions on the relations between control-value appraisals, on the one hand, and several groups of emotions, on the other, in a recent extension of CVT (Pekrun, 2021). The resulting generalized version of CVT extends the perspective on emotions in education (and beyond) by explaining not only achievement emotions but also epistemic emotions, social emotions, and existential emotions.

Epistemic Emotions

Generating and acquiring knowledge can involve intense emotions linked to the cognitive properties of knowledge (Pekrun & Stephens, 2012). Prime examples are surprise, curiosity, and confusion. These three emotions are prompted by cognitive incongruity, but in different ways. Surprise is triggered when prior expectations are not confirmed. Being based on expectancy violations, CVT considers surprise a retrospective emotion, similar to retrospective achievement emotions. In contrast, curiosity is aroused when there is a gap between current and desired knowledge, thus rendering curiosity a prospective emotion. Confusion is prompted when current information seems contradictory and not understandable.

Whereas surprise may be triggered by incongruity alone (see Neta & Kim, 2023, and Reisenzein et al., 2019, for a discussion), curiosity and confusion are additionally thought to be influenced by perceptions of control and value. Curiosity is triggered by awareness of a knowledge gap, but this awareness alone is not sufficient to cause curiosity. In addition, curiosity requires a sense of control that the gap can be closed (Pekrun, 2019; Peterson & Cohen, 2019). Furthermore, curiosity requires that the knowledge needed to close the gap is desired (i.e., that it has value). As such, CVT proposes that curiosity is a joint function of all three appraisals. More specifically, the theory posits that this function takes a multiplicative form. All three appraisals are needed for curiosity to be prompted. If any one of them is zero, curiosity is not aroused. Above the zero level, curiosity increases with increasing incongruity, control, and value. In other words, curiosity is a function of a *positive interaction* between the three appraisals.

However, this function is thought to hold up only to some medium level of incongruity. If the gap is too wide, control may be reduced – the wider the gap, the lower one's expectations to be able to close it. If there is no expectation that the gap can ever be closed, curiosity will subside. By implication, the multiplicative combination of incongruity, control, and value reaches its maximum at a moderate level of incongruity. As such, these CVT propositions lead to the same conclusion as Loewenstein's (1994) information gap theory: Curiosity is most intense with a moderate amount of incongruity.

Confusion is thought to result from contradictions in current information that cannot easily be resolved. For confusion as well, incongruity is not sufficient. In addition, confusion requires appraisals of control and value. In contrast to curiosity, confusion is thought be a function of a *negative interaction* between the three appraisals. Confusion increases with increasing incongruity and value, and with decreasing control. It reaches its maximum with high incongruity and high value, combined with a lack of control.

Over time, unresolved confusion can transit into epistemic *frustration* and *boredom* (D'Mello & Graesser, 2012). Frustration is also thought to result from a negative interaction between incongruity, control, and value. High incongruity when working on an important problem, coupled with a lack of control, leads to frustration if it is left unresolved. If confusion and frustration persist, the problem may lose its personal meaning and be devalued, thus resulting in *boredom*. In contrast, if important gaps are closed and troubling incongruity is resolved, then curiosity, confusion, and frustration can be replaced by *delight* about the solution. Delight may be a positive function of the amount of incongruity and the perceived importance of the problem, but may be independent from prior perceptions of control, similar to control-independent joy about success as addressed earlier.

Social Emotions

Two groups of social emotions are (1) emotions related to one's own attributes and actions as they can be perceived by others, such as pride, shame, and guilt (*self-related social emotions*), and (2) emotions related to other persons, like love,

gratitude, admiration, compassion, hate, anger, contempt, and envy (*other-related social emotions*; Table 2). CVT proposes that all these emotions depend on the perceived value of attributes and actions of oneself or other persons, respectively. In addition, many of them also depend on perceptions of control.

Self-Related Social Emotions *Pride* and *shame* can relate to (a) one's attributes, such as physical appearance, intelligence, or financial status; (b) one's actions, such as courageous behavior or a lack thereof; or (c) the outcomes of actions, such as a rise or loss in social status. Pride depends on the positive value of these attributes, actions, or outcomes, and shame on their negative value. In addition, pride and shame related to actions and outcomes are thought to depend on internal causal attributions. Action-related pride and shame occur when actions – such as effort or lack thereof – are attributed to one's own goals and intentions. Outcome-related pride and shame occur when outcomes are attributed to one's actions, such as the acquisition of a new home being attributed to the investment of thought, time, and money. Feelings of *guilt* relate to negatively valued actions and outcomes that are under one's control (Hareli & Weiner, 2002), thus making guilt also dependent on internal attributions.

CVT proposes that control-dependent pride, shame, and guilt depend on the interplay of control and value, similar to combinations of control and value generating achievement emotions as explained earlier. They are not aroused if the respective attributes, actions, or outcomes are not deemed important. Value alone, however, is not sufficient to generate these emotions; perceptions of control – or lack of control – are needed as well.

Other-Related Social Emotions *Love*, *sympathy*, *hate*, and *antipathy* relate to others as whole people. They imply appraisals of value; additional appraisals are not needed. *Gratitude* and *anger* relate to actions of other persons that have consequences for oneself. These two emotions depend not only on the value of these outcomes, but also on external attributions of the outcomes to the other persons' actions (Hareli & Weiner, 2002). If the other person is not held responsible, there is no reason to be grateful or angry about this person.

Admiration and *contempt* can relate to others' attributes, such as their talent, or to their actions, such as their moral behavior ("admiration for skill" vs. "admiration for virtue"; Immordino-Yang et al., 2009). Admiration and contempt related to attributes depend on social comparison, in addition to value. Admiration is caused by upward comparison, contempt by downward comparison. Admiration and contempt for actions depend on attributions of control – people are admired or condemned for behavior that is under their control rather than due to external causes (such as a runner's new record not prompting admiration when caused by a strong tailwind; Pekrun, 2021).

Compassion and *envy* also depend on perceptions of control, in addition to value. Compassion is caused by the misery of other people, and is boosted if the misery

is caused by external circumstances, such as poverty not being the other person's own fault. Envy is prompted if another person's valued attributes (such as wealth or beauty) are seen as not being self-generated, thus, being undeserved (Feather, 2015). Again, all these control-dependent emotions are thought to depend on the interplay of perceptions of control and value.

Existential Emotions As the term is used in CVT, existential emotions relate to one's existence and health. Similar to achievement emotions, these emotions can refer to present, future, or past events. However, they differ from achievement emotions in one fundamental way. Achievement (i.e., success) cannot be attained without one's own actions. As such, positive achievement emotions fully depend on positive action-control and action-outcome expectancies. In contrast, if situational conditions are favorable, it is possible to live and stay healthy without engaging in health-related activities. As such, situation-outcome expectancies play a critical role for existential emotions, in addition to action-related expectancies.

All existential emotions are thought to depend on the perceived value of health, life, illness, and death. *Happiness*, *sadness*, and *frustration* related to current or past health and illness do not require additional appraisals. In contrast, prospective *hope, anticipatory joy, anxiety* and *hopelessness* additionally depend on perceptions of control as implied by situation-outcome, action-control, and action-outcome expectancies. Health is expected, and positive emotions are prompted, when the situation or oneself are thought to exert a positive impact. Illness or death are expected, and negative emotions are triggered, when the situation leads to a deterioration of one's physical status and sufficient countermeasures are not in sight.

Distal Antecedents, Effects on Behavior, and Reciprocal Causation

Beyond addressing the role of appraisals, the generalized CVT incorporates propositions on the role of distal individual antecedents and social environments, the effects of emotions on behavior, mechanisms of reciprocal causation, and ways to regulate emotions (Fig. 3; Pekrun, 2021). These propositions expand upon CVT propositions for achievement emotions. Similar to achievement emotions, other types of emotions are also thought to be influenced by individual and social factors that shape perceptions of control and value. In turn, emotions are expected to influence behavior and outcomes, such as health-related emotions prompting health-related activities. Furthermore, emotions are generally proposed to be linked to outcomes and antecedents in a reciprocal fashion. By implication, the strategies for managing achievement emotions outlined above are thought to be similarly relevant for emotion regulation and intervention targeting epistemic, social, and health-related emotions.

Implications for Educational Practice

CVT can be used to assess, understand, and change emotions in education. Some of the practical implications of the theory are the following.

Assessment of Emotions

Based on CVT, we have developed instruments to measure achievement emotions and epistemic emotions that can be used in educational research and practice, both for assessing emotions in individual students and for large-scale assessments. The Achievement Emotions Questionnaire (AEQ) and its variants assess achievement emotions. In its original version (Pekrun et al., 2011), the instrument was based on a preliminary taxonomy of achievement emotions (Pekrun et al., 2002) and used to measure nine of these emotions in university students (for a short version, see Bieleke et al., 2021). Subsequent variants were designed to assess achievement emotions in elementary and high school students, including domain-specific emotions such as emotions in mathematics and language learning (Bieleke et al., 2023; Lichtenfeld et al., 2012; Shao et al., 2023). The revised AEQ (Pekrun et al., 2023a) considers all 12 cells of the full version of the taxonomy. Items from the AEQ have been used in large-scale assessments, such as the cycles of the OECD Programme for International Student Assessment (PISA; e.g., in the PISA science enjoyment scale administered in PISA 2006 and 2015; OECD, 2017). The Epistemic Emotion Scales (EES) assess seven epistemic emotions including surprise, curiosity, enjoyment, anxiety, confusion, frustration, and boredom (Pekrun et al., 2017b).

Understanding Emotions

It is important for educational practitioners to understand students' emotions as well as their own emotions. The descriptive classifications provided by CVT make it possible to understand the manifold nature of emotions in the classroom. In addition, CVT provides explanations of antecedents, effects, and regulation of emotions. Five evidence-based messages from CVT research may be especially important for teachers (Pekrun, 2014). Some of these messages may contradict teachers' prior conceptions, thus making it important for teachers to understand them.

First, teachers may think that students' emotions are fixed parts of their personality that are invariant across situations and time. However, CVT research has shown that academic emotions vary across subject domains and time. To avoid attributions of individual students' emotions to unchangeable personality traits, it is important for teachers to understand the variability and malleability of the emotions students experience. Second, it is important to know that students' self-confidence and intrinsic value appraisals are prime drivers of their enjoyment of learning, whereas lack of self-confidence and excessive importance of achievement outcomes prompt anxiety, shame, and hopelessness. Third, based on the role of self-confidence and value, CVT provides explanations for the importance of classroom instruction, classroom social climate, and the climate in the family for students' emotions.

Furthermore, CVT provides a nuanced account of the impact of emotions on learning and achievement. Teachers may benefit from understanding that the world of emotions is not black and white, which may be counter to their prior conceptions considering positive emotions generally beneficial and negative emotions detrimental. As explained by CVT, positive emotions and a positive mood in the classroom are not always helpful; making them productive for learning requires a focus on the task. Similarly, negative emotions are not always detrimental. For example, the confusion that can be aroused in productive failure instruction can motivate students to solve problems, thus benefitting deep learning (D'Mello et al., 2014; see also Sinha, 2022). However, teachers also need to know that excessive negative emotions are clearly maladaptive. Finally, CVT provides an understanding about the multitude of strategies that can be used to manage the emotions that arise in the classroom.

Changing Emotions

CVT research on the role of classroom instruction and social environments shows how teachers can contribute to promoting adaptive emotions and preventing or reducing maladaptive emotions. From CVT propositions and related evidence, it follows that primary ways for doing this are the following: (1) Increasing the cognitive quality of instruction (clarity and structure), calibrating task demands such that they match students' competencies and involve challenges that can be met, and prompting curiosity and resolvable confusion by inducing moderate amounts of cognitive incongruity; (2) increasing the emotional and motivational quality of instruction by providing information about value, with a focus on intrinsic value rather than achievement value, and by transmitting positive emotions; (3) creating a mastery goal climate in the classroom and communicating achievement expectations that are challenging but can be met; (4) providing autonomy support and fulfilling students' needs for relatedness by using socially interactive task formats; (5) providing informational feedback about achievement and creating an error culture that considers mistakes as opportunities to learn rather than indicators of lack of ability; and (6) calibrating the composition of student groups such that strong reference groups effects are prevented (e.g., by refraining from teaching high-achieving students in separate classes, because this might boost negative emotions like fear of failure).

It is a task for educational policy to change academic institutions such that implementing these classroom structures becomes possible (Linnenbrink-Garcia et al., 2016). A case in point is policies defining assessment practices. Policies that mandate high-stakes testing and make students' educational careers dependent on their current achievement undermine implementation of a mastery-oriented goal structure, instead promoting performance goals, achievement pressure, and adoption of excessively high achievement values (especially regarding the perceived importance of avoiding failure). According to CVT, these factors, in turn, generate excessive anxiety, shame, and hopelessness related to failure, thus, jeopardizing students' mental health. For many education systems around the world, shifting

assessment policies away from high-stakes testing and towards an anxiety-free culture of learning from mistakes would amount to a radical shift in educational policymaking.

Beyond changing educational policy and practices, CVT principles can also be used to design interventions targeting emotions. It follows from CVT that there are three major factors that can put students emotionally at risk: Lack of self-confidence (i.e., lack of control); excessive value of achievement (triggering anxiety); and lack of value (inducing boredom). We are currently developing a control-value intervention that combines components of existing motivation interventions to help students manage these risk factors, including attributional retraining and mindset intervention targeting control, and utility value intervention targeting value (Hoessle et al., 2021). In addition, this intervention includes a treatment component aiming to reduce excessive achievement value.

Strengths, Open Questions, and Future Directions

The editors of this topical collection have asked authors to explain the virtues of their theories. In the following, I describe how CVT fulfils the criteria for the quality of theories in educational psychology that Greene (2022) has distilled from the literature. Subsequently, I discuss open issues and directions for further development.

Virtues of CVT

CVT satisfies criteria of scope by addressing a broad range of achievement emotions, in contrast to previous theories that focused on single emotions (e.g., test anxiety) or a limited range of outcome-related emotions (e.g., attributional theories). The scope of the generalized version of CVT is even broader by considering several groups of human emotions. At the same time, the theory is parsimonious by explaining emotions by a limited number of appraisals and functional relations linking appraisals to emotions. Previous appraisal theories considered a multitude of overlapping concepts of appraisals (see Scherer et al., 2001; Scherer & Moors, 2019). CVT integrates these concepts to increase parsimony. Specifically, control integrates previous appraisal concepts of power, coping potential, certainty, and agency, and value integrates concepts of goal congruency, motive consistency, and pleasantness.

In addition, CVT is comprehensive in terms of not only addressing individual antecedents of emotions, but also the role of social environments and socio-cultural contexts. Furthermore, CVT explains the impact of emotions on learning, achievement, and health, as well as mechanisms of reciprocal causation, emotion regulation, and intervention. The cognitive-motivational model of emotion effects that is part of CVT is more comprehensive than theories that only consider single cognitive or motivational mechanisms (see Barrett et al., 2018).

Comprehensiveness is achieved by integrating and expanding propositions from previous theories, indicating that the theory fulfills criteria of unification (Greene,

2022). To explain the origins of achievement emotions, propositions from expectancy-value theory, attributional theory (Weiner, 1985), and Lazarus's transactional model (e.g., Lazarus & Folkman, 1984) are integrated. To explain effects on learning and achievement, CVT synthesizes propositions from theories of effects on motivation, cognitive resources models (Meinhardt & Pekrun, 2003; Mikels & Reuter-Lorenz, 2019), and theories focusing on emotions and modes of thinking (e.g., Clore & Huntsinger, 2007). Beyond the emotion domain, CVT provides prospects for unification with motivation theory, given that CVT's explanations of prospective emotions are conceptually equivalent with the explanations of motivation provided by self-efficacy theory and expectancy-value theories. Given the theoretical integration offered by CVT, the theory also shows "external consistency" and "analogy" (Greene, 2022) relative to other theories in the field.

Both the descriptive parts of CVT and its explanatory propositions are sufficiently specific to be testable. The three-dimensional (object focus x valence x arousal) conception of achievement emotions has been tested using dimensional modeling and facet analysis (see Pekrun et al., 2023a for methodology and evidence supporting the taxonomy). In terms of explanations, CVT provides directional hypotheses for the links between emotions, antecedents, and outcomes. Some of these hypotheses have been formalized (see Pekrun, 1992a, 2006, for formal hypotheses on control-value antecedents and prospective emotions) and include conceptions of non-monotonic and interactive functional relations.

Testability implies that CVT propositions can be confirmed or disconfirmed by empirical evidence. As such, the congruency between propositions and the evidence that has accumulated over the past 25 years is not trivial. Of note, there are a few findings that seem to contradict the theory at first sight, but do not do so upon closer scrutiny. For example, studies have found that measures of value correlate negatively with negative emotions, in contrast to CVT's proposition that value amplifies all emotions, both positive and negative (except boredom). However, typically these studies measured positive value, thus, failing to differentiate between positive and negative value. CVT proposes that positive value boosts positive emotions, and that it is negative value which prompts negative emotions (such as the perceived negative value of failure exacerbating students' test anxiety). Empirically differentiating between types of values confirms the more specific links between value appraisals and emotions posited in the theory (Pekrun et al., 2023a).

Finally, the theory shows practicality. While I do not think that all theories in educational psychology need to be applicable in practice, CVT is. As outlined earlier, the theory can be used to describe, assess, and understand emotions that are relevant to education, and it can be used to change educational practices in affectively sound ways.

Open Questions and Future Directions

Relative to its early version, CVT has become a comprehensive, mature theory that is backed up by robust evidence. Nevertheless, open problems remain, in terms of further developing the theory, empirical research testing it, and designing

interventions. A few of these open questions and future directions are the following (for more complete treatments, see Pekrun, 2018, 2021; Pekrun & Goetz, 2024b; Pekrun & Linnenbrink-Garcia, 2014).

Further Developing CVT

Explaining Multiple Emotions The generalized version of CVT explains four groups of emotions. It is sensible to assume that appraisals of control and value are also critically important for emotions not covered by these four groups, such as aesthetic emotions (Menninghaus et al., 2019), religious emotions, political emotions, or emotions related to physiological need fulfillment. Emotions can be triggered by any situations, actions, or objects that are personally valuable, and perceptions of control over these referents of emotions are likely to contribute to these emotions. As such, I anticipate that it will be possible to further generalize CVT and to develop control-value models for types of emotions not yet considered in the theory.

The challenge in such a development is to keep an adequate balance between generality and specificity. Existing general appraisal theories of emotions provide propositions that purportedly hold for all emotions (Scherer et al., 2001), but neglect the specificity of emotions in defined domains (such as the achievement and social domains). Conversely, domain-specific theories explain emotions occurring in specific settings, but lack generality beyond these settings. Any emotion theory that aims to render in-depth explanations while at the same time being comprehensive needs to be sufficiently specific while also providing general principles that hold across groups of emotions. The generalized control-value theory has been constructed to reach this aim. Future theory development will show how it can be further revised to explain additional groups of emotions in a way balancing generality and specificity.

The Role of Socio-Cultural Contexts CVT includes propositions on the role of social environments, institutions, and the broader socio-cultural context. For the impact of cultural contexts and cultural values, further theoretical work is needed. For example, what exactly is the role of social stereotypes and socio-economic disparities associated with gender, ethnicity, race, or social class, and the differences between these stereotypes and disparities across cultures, for the development of students' emotions? Similarly, what are the implications of the current globalization of some cultural values (such as achievement values) and shrinking between-culture differences relative to within-culture differences for the development of emotions (see Pekrun, 2018)?

Relative Universality As noted, CVT proposes that objects and distributional properties of emotions vary across persons, situations, and contexts, whereas the basic functional mechanisms of emotions are thought to be universal. Two related questions need further theoretical (and empirical) clarification (Pekrun & Goetz, 2024b). First, what exactly are the basic mechanism that can be presumed to be universal; at

which level of granularity are they located? This question is especially difficult to answer for effects of emotions on performance. CVT's cognitive-motivational model of emotion effects posits that emotions influence various mediating processes. The balance of effects on these processes can vary across persons and task conditions, such that one and the same emotion can have positive or negative overall effects on performance. For example, if the negative effects of anxiety on working memory resources and intrinsic motivation outweigh positive effects on extrinsic motivation, then anxiety should impair performance. If positive effects outweigh negative effects on these mediating mechanisms, then anxiety should boost performance. To define the balance, further work on these mechanisms and their modular organization is needed.

Second, even if the general functional form of basic relations is universal, it may well be that some parameters of these relations vary. For example, CVT proposes that anxiety is a curvilinear function of the subjective likelihood of a negative event, with anxiety being replaced by hopelessness when the likelihood of the event approaches 1. However, it is sensible to assume that the increase of anxiety as a function of likelihood is steeper for some persons and some events than for others, and that the maximum intensity of anxiety is reached earlier for these persons or events (e.g., highly trait anxious persons as compared with less trait anxious persons). Theory and evidence are needed to clarify possible variations in the functional form of universally observable relations.

Empirical Research and Intervention Studies

Sample Sizes and Replicability Most studies on emotions, including research on emotions in education, are based on samples of persons, situations, and measurement occasions that are relatively small and not representative for the respective populations. Small samples are known to increase the variability of parameter estimates (e.g., Schönbrodt & Perugini, 2013), thus jeopardizing replicability and generalizability (see also Pekrun, 2023). To an extent, sample limitations of single studies can be overcome by meta-analytically integrating the findings from multiple studies. However, limitations that are shared by the single original studies cannot be ameliorated this way. For example, if original studies are biased by only including samples from Western countries, then related meta-analytic findings are biased as well. Systematic efforts are needed to overcome these limitations in CVT research and beyond, including large-scale, multi-country representative studies as well as multi-lab studies that combine the efforts of several research groups in systematic ways.

Measurement Research testing CVT has largely relied on self-report measures of emotions. Self-report is indispensable for assessing emotions in a nuanced way (Pekrun, 2020). Variations in the affective flavor of emotional feelings, and details of the accompanying thoughts, can only be assessed through directly asking persons about their emotions. However, self-report of emotions has two limitations. First,

self-report is subject to memory biases and the influence of response sets (such as social desirability). Second, self-report is not well suited to assess the physiological and behavioral component processes of emotions, like physiological arousal and facial expression. To more fully measure the emotions targeted by CVT, it is important to use multiple channels also including behavioral observation, physiological analysis, and neuro-imaging (see, e.g., Martin et al., 2023, and see Pekrun, 2023, for proposed guidelines). Advances in these methodologies are needed to more fully test the multivariate dynamics and multiple loops of reciprocal causation across different timeframes that link emotions, origins, and outcomes according to CVT (e.g., using nonlinear dynamic systems modeling; see also Marchand & Hilpert, 2023).

Study Designs The majority of CVT studies have used correlational designs. Even longitudinal studies testing CVT propositions have often not sufficiently controlled for third variables that may have generated the observed relations. To make further headway in testing the causal propositions of CVT, we need to use designs that allow stronger causal conclusions than provided by cross-sectional or predictive correlations. Experimental designs can be used for this purpose, but are limited by ethical restrictions on inducing intense emotions. As such, we additionally need to consider longitudinal causal designs, such as natural experiments, regression discontinuity designs, or cross-lagged panel designs controlling for confounders (see Hamaker, 2023; Hamaker et al., 2015; Lüdtke & Robitzsch, 2022; Marsh et al., 2022).

Between- and Within-Person Analysis The majority of studies testing CVT, and of studies in educational psychology more generally, have used between-person designs. This is true both for field studies that focused on between-person correlational analysis, and for experimental research that typically used between-subjects designs. However, CVT propositions on antecedents and effects of emotions refer to within-person functional mechanisms, similar to theories of cognition and motivation that typically also refer to within-person processes. Between-person findings do not allow any direct conclusions about within-person relations among variables, except if conditions of ergodicity hold (Murayama et al., 2017). As such, to more directly test CVT hypotheses, between-person research needs to be complemented by within-person studies (see Pekrun et al., 2023b, 2023a, for CVT studies using random-intercept cross-lagged panel modeling and dynamic structural equation modeling, respectively).

Age Groups, Settings, and Cultural Contexts Most CVT studies have focused on students' emotions in secondary school, with a smaller number of studies investigating emotions in higher education (Camacho-Morles et al., 2021). Research on emotions in younger children is needed to elucidate the development of the cognition-emotion links posited by CVT as a function of children's age and cognitive development. Given the increasing importance of continuing, adult, and professional education, we also need systematic research on emotions in post-tertiary education. Similarly, more CVT-based research on emotions in digital learning environments (such as MOOCs, serious games, and virtual environments) is needed (see, e.g., Lajoie &

Poitras, 2023, and see Loderer et al., 2019, 2020, for CVT perspectives on emotions in these environments).

Furthermore, existing CVT research has typically included samples from WEIRD (Western, Educated, Industrialized, Rich, Democratic) countries. In addition, there is currently a growing number of studies from East Asian countries including China, Japan, and South Korea. To understand emotions across various cultural contexts and more broadly test the generalizability of CVT, we need inclusive research that also considers students' and teachers' emotions in countries in the Middle East, Southern and South-Eastern Asia, Africa, and Latin America.

Intervention Studies In its first stage, CVT research has focused on investigating individual antecedents and effects of emotions, including the links between emotions and control-value appraisals as well as achievement. Once these links had been confirmed, researchers increasingly turned to exploring the impact of classroom instruction and learning environments on emotions (see, e.g., Loderer et al., 2020). The findings of this second-stage research confirm that instruction and the social climate in the classroom have a profound impact on students' and teachers' emotions. As such, these findings also make it possible to derive recommendations for practice. However, as yet this research has largely focused on investigating existing learning environments and modes of instruction. In addition, we need emotion-focused intervention research that is explicitly designed to change learning environments and provide individual treatment across a broad range of emotions, such as research on the control-value intervention mentioned earlier. This third-stage CVT research will make it possible to more fully explore ways to help students (and teachers) to develop adaptive and prevent or reduce maladaptive emotions, thereby promoting learning and teaching as well as identity development, health, and emotional well-being.

Conclusion

Over the past 30 years, CVT has developed in three major phases. Early theoretical work comprised separate models targeting one single emotion (anxiety) and the effects of emotions on cognitive performance. CVT integrated these models and expanded them to explain a broader range of achievement emotions, including both outcome emotions related to success and failure, and activity emotions related to achievement activities like studying. Recognizing that emotions beyond the achievement domain are critically important as well, the recent generalized version of CVT additionally explains epistemic, social, and existential emotions. The generalized CVT provides a platform for overcoming fragmentation in research on emotions in education (and beyond) by addressing these various groups of emotions, their individual and social antecedents, their effects, and their regulation in an integrative fashion. Nevertheless, challenges remain. We need refined tests of the theory using

multi-channel measurement, dynamic modelling, and an integration of idiographic and nomothetic perspectives; further theoretical advances to more fully explain the diversity of emotions across persons and sociocultural contexts; as well as development of effective interventions and educational practices that target emotions to promote students' and teachers' affective health.

Declarations

Conflict of Interest The authors do not have any conflicts of interest to disclose.

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