Emotions in Education

Goetz, T., Frenzel, A. C., Stockinger, K., Lipnevich, A. A., Stempfer, L., & Pekrun, R. (in press). Emotions in education. In R. Tierney, F. Rizvi, and K. Ercikan (Eds.). *International Encyclopedia of Education (4th edition)*. Elsevier Science: Amsterdam.

Thomas Goetz, Anne C. Frenzel, Kristina Stockinger, Anastasiya A. Lipnevich, Lisa Stempfer, & Reinhard Pekrun

Thomas Goetz
Universitätsstraße 7 (NIG)
A-1010 Wien
Austria
Phone: +43-1-4277-47401
Email: thomas.goetz@univie.ac.at
Department of Developmental and Educational Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria

Anne C. Frenzel
Leopoldstr. 13
D-80802 München
Germany
Phone: +49-89-2180–72557
Email: frenzel@psy.lmu.de
Department of Psychology, Ludwig-Maximilians-Universität München, Munich, Germany

Kristina Stockinger
Universitätsstraße 10
D-86159 Augsburg
Germany
Phone: +49-821-598-5596
Email: kristina.stockinger@phil.uni-augsburg.de
Faculty of Philosophy and Social Sciences, University of Augsburg, Augsburg, Germany

Anastasiya A. Lipnevich
365 5th Ave, New York
NY 10016
USA
Phone: +1-732-762-6541
Email: a.lipnevich@gmail.com
Queens College and the Graduate Center, The City University of New York, New York, USA

Lisa Stempfer
Universitätsstraße 7 (NIG)
A-1010 Wien
Austria
Phone: +43-1-4277-47416
Email: lisa.stempfer@univie.ac.at
Department of Developmental and Educational Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria

Reinhard Pekrun
Wivenhoe Park
Colchester CO4 3SQ

Phone: +44-208-508-5983
Email: pekrun@lmu.de
Department of Psychology, University of Essex, Colchester, United Kingdom; Institute for Positive Psychology and Education, Australian Catholic University, Sydney, Australia; Department of Psychology, University of Munich, Munich, Germany

Keywords:
Academic, Achievement, Affect, Anxiety, Control-Value Theory, Emotion, Mood, Student, Teacher

Abstract

Emotions are a central part of our existence. The nature, causes, and corollaries of emotions have been investigated in various scientific disciplines, from philosophy and sociology to psychology and biology. In this chapter we aim to contribute to our current understanding of emotions. We take a psychological perspective on emotions, with a particular focus on their roles in educational settings. We discuss both students' and teachers' emotions. First, we define emotions and outline different ways of measuring them. We then present findings demonstrating their causes and their effects on individuals' cognition, learning, and achievement. Finally, we outline avenues for designing emotionally healthy learning environments.

1 Conceptualization and Measurement of Emotions in Education

1.1 Conceptualization

What do we mean, from a psychological perspective, when we speak of emotions? Despite certain nuanced differences in definitions, there is a general agreement in the field about the multi-componential nature of emotions. In line with Scherer (2000; see also Scherer and Moors, 2019), we describe emotions as follows: An emotion is an evaluative reaction to an important external or internal stimulus (or mental representation thereof; e.g., a fond memory) that encompasses various psychological and physical subsystems (affective, cognitive, motivational, physiological, and expressive) and serves to be able to react as quickly and flexibly as possible to a given situation.

This multi-componential conceptualization makes an emotion a more or less clear-cut psychological phenomenon. It also implies that each emotional experience is characterized by a central nervous and peripheral-physiological reaction pattern that is reflected in subjective feelings, motor reactions (especially in facial expressions, but also gestures and posture), motivational tendencies (specifically, approach versus avoidance tendencies), and cognitions (specifically, emotion-typical thought content).

Various approaches have been proposed to order and categorize different emotions above and beyond their constituent components. Most importantly, dimensional approaches presuppose placing the variety of emotional experiences in a space of a restricted range of meaningful descriptive dimensions. Probably the most widely used dimensional model is the circumplex model of affect that classifies emotional experiences along two orthogonal dimensions, namely valence (ranging from unpleasant to pleasant) and arousal (ranging from calm to alert; see Posner et al., 2005). For example, according to this approach, both anxiety and anger would be categorized as unpleasant, highly arousing emotions. Of course, there are also other ways to categorize emotions, for example, according to their timing (i.e. whether they primarily occur before, during, or after an event) or their object focus (e.g., self- or other-related; social, topic, or outcome-related; see below).

A further conceptual aspect worth considering in the context of emotions is that they can be understood either as states – that is, momentary experiences – or traits – that is, habitual experiences (e.g., trait test anxiety; Spielberger et al., 1976). Emotional states are often very short-lived. In contrast, when considering emotions as traits, the emphasis is on the fact that individuals differ in their tendency (or disposition, susceptibility, proneness) to experience certain

emotional states more readily and frequently, and/or more intensely. In line with the definition of 'trait' as a core concept in personality psychology, emotional traits are supposed to be relatively stable over time. As discussed in more depth below, differentiating between emotions as states versus traits represents an important conceptual distinction for scientific inquiry into emotions, and has important implications for their measurement.

1.2 Measurement

Due to the fact that emotions are characterized by individuals' subjective experiences, it stands to reason that they can be assessed quite simply with self-report, that is, by asking individuals about these experiences. This can take the form of open-ended questions, with individuals reporting their emotional experiences through interviews, focus groups, or video-stimulated recall methods. Alternatively, it can take the form of closed-ended Likert-type items pertaining to verbal emotion descriptions, visual stimuli, or a combination of both (see Schutz et al., 2016, for a discussion of tools and approaches to gauging emotions in education). In so doing, researchers need to decide whether to assess emotions as states, by asking, for instance, 'How do you feel right now?', or as traits, by asking 'How do you generally feel?'. States are often assessed via so-called 'experience sampling methods' (Larson and Csikszentmihalyi, 2014; see also Goetz, Bieg, and Hall, 2016) where participants are, for example, asked to rate their emotional states at multiple, typically randomly determined instances across lessons, days, or weeks. Digital self-reports are also used to explore learners' state emotional experiences embedded in online learning environments (D'Mello et al., 2017; Harley, 2016). Traits can be assessed by asking about how one typically feels with respect to specific types of situations (e.g., mathematics tests). An alternative way of indexing trait emotions is obtaining an average across various emotional state measures with respect to a specific type of situation. This way, individuals' relative tendency to experience a certain emotion in a particular situation is captured.

A widely-used self-report instrument for the assessment of learners' habitual, trait-like emotional experiences in achievement contexts is the Achievement Emotions Questionnaire (AEQ) developed by Pekrun and colleagues. The measure was originally created for the use with university students (Pekrun et al., 2011) and later adapted for the use with K-12 students, and contextualized for specific school subjects (e.g., AEQ-mathematics; Frenzel et al., 2007). The AEQ is intended to assess learners' class-related, learning-related, and test-related experiences of enjoyment, hope, pride, relief, anger, anxiety, shame, hopelessness, and boredom (sample items: 'I enjoy being in class', 'I'm proud of how well I mastered the exam', 'While studying I drift off

because it's so boring'). A short version of the AEQ (i.e., four items for each scale) also exists (Bieleke et al., 2021). Additionally, drawing upon AEQ, Frenzel and colleagues developed a self-report instrument to assess teachers' habitual experiences of enjoyment, anger, and anxiety during teaching (Teacher Emotions Scales, TES; Frenzel et al., 2016) with four items per emotion scale (sample items: 'I enjoy teaching', 'I often have reasons to get angry when I teach', 'I am often worried that my teaching isn't going so well').

Although self-report approaches have face validity and allow for an efficient measurement of emotions, they also entail possible problems because they are prone to conscious and non-conscious biases. For example, a teacher may not want to admit that they are highly excited or agitated during teaching, or students might exaggerate their test anxiety hoping this can result in lenient grading (Pekrun, 2020; Pekrun and Bühner, 2014). In order to mitigate these potential biases, objective methods of assessing emotions have been developed that are meant to bypass participants' subjective responses. This might be achieved through qualitative methods of observation or in-depth ethnographic inquiry methods (Schutz et al., 2016). One can also make use of the expressive component of emotions by coding and quantifying typical emotion-related facial expressions (Ekman et al., 2002), which can be executed through artificial intelligence-based facial feature recognition (see e.g., Frenzel et al., 2019). Additionally, one can assess physiological processes associated with emotional experiences. These assessment approaches used to be solely lab-based, but recent technology in the form of so-called 'wearables' allows for tracking a number of peripheral-physiological measures including skin-conductance, heart rate, or blood pressure, as individuals engage in certain tasks in educational settings (including classrooms; see e.g., Donker et al., 2018). Additionally, cortisol found in saliva has been used by researchers as an indicator of increased emotional arousal, and considered in the context of research on fear or stress, including test anxiety (Mattarella-Micke et al., 2011). Finally, scholars have also employed functional magnetic resonance imaging (fMRI) and electroencephalography (EEG; see e.g., Dikker et al., 2017) to examine brain-based processes underlying individuals' emotional experiences. However, with the exception of analyzing facial expressions, self-report still constitutes the only suitable approach for assessing specific emotions (e.g., anxiety, anger, surprise) rather than valence or arousal more broadly, especially in instructional settings (see Roos et al., 2021).

1.3 Emotions in Education

1.3.1 Short history of emotions in education

Existing research into emotions in education dates back to inaugural studies on test anxiety, conducted in the 1930s (e.g., Brown, 1938). Throughout the 20th century, research that focused on achievement emotions was largely restricted to anxiety, and test anxiety continued to be by far the most prominent construct in research on emotions in education. Test anxiety has attracted researchers' attention since Mandler and Sarason (1952) proposed their habit interference model of anxiety and learning. Empirical evidence has confirmed the importance of anxiety for understanding human performance (Hembree, 1988; Zeidner, 1998; Richardson et al., 2012). Since the late 1960s, attributional research has broadened the perspective by considering cognitive antecedents of different emotions following success and failure, such as pride, gratitude, shame, guilt, and anger (Weiner, 1985). Researchers have further expanded the scope of inquiry during the past 20 years by exploring a broad range of achievement emotions, including, for example, enjoyment, hope, surprise, anger, boredom, disappointment, and hopelessness (Pekrun, 2006, 2018; Pekrun and Linnenbrink-Garcia, 2014; Pekrun, Muis et al., 2017). In addition to the increasing number of different emotions that are being examined in education, the variety of contexts (e.g., achievement vs. non-achievement context), situations (social vs. non-social situation), and academic domains (e.g., mathematics, language domain), in which these emotions are being studied, has been growing exponentially during the last 20 years.

In the context of recent research on academic emotions, different groups of emotions have been identified with respect to activities, situations, and content areas to which emotions refer (i.e., their object focus). These groups include achievement emotions that are strongly related to experiences of success and failure, epistemic emotions that are caused by perceived gaps and changes in knowledge, social emotions (e.g., envy, contempt or affection for others in the classroom), as well as topic-related emotions that are directly triggered by the learning object (Pekrun, Muis, et al., 2017).

1.3.2 Groups of academic emotions

An overwhelming proportion of existing studies on emotions in education focuses on *achievement emotions*. Therefore, in this chapter, we pay particular attention to this group of emotions. These are emotions that occur in relation to achievement-related activities (i.e., solving a math task, or memorizing vocabulary; Camacho-Morles et al., 2021) as well as results of these activities (i.e., getting the task right, or failing to remember the correct translation), which, for students, often involve informal as well as formal achievement feedback in the form of grades or teacher comments (see Lipnevich and Smith, 2018). This feedback has been shown to elicit a

range of emotions, which relate to improved or reduced motivation and performance. The ubiquity of feedback situations that inevitably elicit a wide variety of achievement emotions in students has become the focus of attention of researchers (Goetz et al., 2018; Lipnevich and Smith, 2009). Interestingly, links between specific emotions and feedback are not straightforward, and are often counter-intuitive. Specifically, positive emotions resulting from praise may tend to result in decreased motivation to invest further effort in a task (e.g., Brummelman, 2020; Lipnevich and Smith, 2009), whereas negative emotions resulting from low grades may enhance student motivation (Lipnevich et al., 2021; Turner and Schallert, 2001). Key examples of achievement emotions in relation to past achievement outcomes are pride, relief, shame, anger, and disappointment. With regard to impending achievement evaluation, anxiety, hopelessness, and hope may be experienced. Finally, joy, frustration, or boredom are typical achievement emotions that are related to achievement activities themselves (e.g., studying, completing in-class activities).

Epistemic emotions have recently started to play a major role in research (Muis et al., 2018; Pekrun and Stephens, 2012). The term 'epistemic' is derived from ancient Greek and denotes thoughts and activities that aim to expand human knowledge, as exemplified by the pioneering thinking of the Greek philosophers. Thinking, however, is not just based on pure cognitive reasoning alone ('cold cognition'). Rather, it is closely tied to emotions such as surprise, curiosity, or confusion, which relate to the knowledge-generating qualities of cognitive tasks and drive the exploratory activities that are needed to expand knowledge. For these emotions, knowledge and the generation of knowledge are the objects of emotions (Pekrun, 2021a). A prototypical situation for the arousal of epistemic emotions is discrepant information and cognitive incongruity, which implies that different pieces of information are not compatible and do not fit together. A typical sequence of epistemic emotions induced by cognitive incongruity may involve (1) surprise; (2) curiosity and situational interest if the surprise is not resolved; (3) confusion when the incongruity cannot be resolved; (4) anxiety in case of severe incongruity and information that deeply disturbs existing beliefs; (5) enjoyment and delight experienced when the incongruity gets solved; or (6) frustration when solving the incongruity seems impossible.

There is also an increasing interest in *social emotions* and how they manifest in educational contexts (e.g., Immordino-Yang, 2010), although this area is less explored compared with work on achievement emotions and epistemic emotions. Learning is situated in social

contexts. Even when studying alone, students never find themselves in a social vacuum; rather, the goals, contents, and outcomes of learning are socially constructed. By implication, academic settings induce a multitude of social emotions that include both social achievement emotions (such as admiration, envy, contempt, or empathy related to the success and failure of others) and non-achievement social emotions (such as love or hate in relationships with classmates and teachers). Similarly, teachers' professional activities are social in nature. Classroom teaching, interacting with colleagues, and giving advice to parents elicits a range of social emotions. Even if other people are not physically present, for example, during lesson preparation or marking exams at home, social emotions may still be prominent (e.g., getting angry at administrators for requiring detailed lesson plans).

Finally, there is the group of *topic emotions*, that is, emotions that are triggered by the contents of a learning task (Pekrun and Linnenbrink-Garcia, 2022). This group of emotions seems to be the least researched. Examples are empathic emotions pertaining to a protagonist's fate when reading a novel, emotions triggered by political events discussed during politics lessons, or emotions related to topics in science class, such as students' anxiety when told about predictions of rising temperatures related to global climate change. In contrast to achievement and epistemic emotions, topic emotions do not directly pertain to learning and problem solving, and are much narrower and more task-specific.

2 Origins of Emotions

2.1 General Approaches to the Origins of Emotions

Why do we experience emotions in the first place? How are emotions triggered? According to a biological perspective that considers basic physiological processes of emotions from the standpoint of the phylogenetic development of humans, emotions offer a survival advantage by preparing the organism to act adaptively. In contrast to instincts which imply highly automatic stimulus-response couplings, emotions provide the basic direction of behavior (e.g., approach or avoidance), which can then be adapted to the specific situation. Cognitive approaches to emotions focus on the extent to which cognitions (such as relevance judgments, attribution of causes of events) are involved in the genesis of emotions. Particularly influential are appraisal theories, which state that it is not situations themselves that evoke emotions, but rather, our interpretations and subjective evaluation of these situations. Finally, researchers who take a social-constructivist approach to emotions argue that they are social constructions strongly shaped by cultural and societal factors. For further reading on the origins of emotions, we

encourage the reader to consult the Handbook of Emotions (Barrett et al., 2016; for further reading on appraisal theory, see Moors et al., 2013; Scherer and Moors, 2019).

2.2 Origins of Emotions in the Context of Education

2.2.1 Appraisal antecedents of achievement emotions

A theory that addresses a broad range of emotions in education is Pekrun's control-value theory (CVT) of achievement emotions (Pekrun, 2006, 2018). This theory focuses primarily on achievement emotions (for a more generalized version of the CVT that also addresses social, epistemic, and other emotions, see Pekrun, 2021a). In addition to being grounded in appraisal theory, CVT integrates propositions from transactional theories of stress-related emotions (Lazarus and Folkman, 1984), attribution theory (Graham and Taylor, 2014; Weiner, 2007), and has a conceptual relation with expectancy-value theories of achievement motivation (Eccles and Wigfield, 2002; Pekrun, 1993; Wigfield and Cambria, 2010). The CVT posits that two appraisals are particularly important for the arousal of achievement emotions, namely, individuals' subjective control over learning- and performance-related activities and outcomes, and their subjective value of these activities and outcomes (see Figure 1). Subjective control refers to one's perception of being able (or unable) to influence achievement activities and their results. Value appraisals have a categorical and a dimensional facet, in line with value concepts in other disciplines (e.g., economics). The categorical facet pertains to judgments of achievement activities and their results as desirable (positive value) or undesirable (negative value), whereas the dimensional facet pertains to how important or personally significant the activities or achievement results are (low vs. high positive or negative value).

According to the CVT, how one feels in a given achievement situation depends on the individual's combination of current control and value appraisals. Control determines our expectation of success or failure and, consequently, whether we experience positive (i.e. pleasant) or negative (i.e. unpleasant) emotions. For example, if perceived control over an upcoming exam is high and we expect success, we will tend to experience enjoyment. If, however, perceived control over achievement outcomes is very low, we may experience hopelessness. The value appraisal determines how important success or failure is in a given situation. Control and value appraisals jointly determine the intensity of the emotional experience. That is, the higher one's perceived control over the process or the outcome of a task, and the higher their positive value, the stronger the resulting positive emotions are. Conversely, from low control and high negative value, intense negative emotions will result. One exception with regard to the latter contingency

is boredom, in that boredom is less pronounced when a learning task or a situation is considered important or personally relevant (Goetz et al., 2019).

Links between students' control and value appraisals, and a range of achievement emotions have long been supported by extensive empirical evidence (e.g., Forsblom et al., 2022; Pekrun and Perry, 2014; Loderer et al., 2020; Putwain, Becker, et al., 2018; Shao et al., 2020). Typically, studies addressing those links used students' self-concepts or perceived competence as proxies for control appraisals, and their beliefs about the importance of achievement, and/or the personal relevance of the material to be learned, as proxies for value appraisals, focusing on trait-level mechanisms. Studies addressing links between situation-specific judgements and state achievement emotions are relatively rare (e.g., Ahmed et al., 2010; Goetz et al., 2010; Goetz et al., 2020). Interestingly, trait- and state-level approaches provide convergent evidence regarding the direction of relationships as proposed by the CVT (Goetz, Sticca et al., 2016), implying that emotional mechanisms operate in similar ways at both levels of analysis.

2.2.2 Social-cognitive antecedents of emotional appraisals

Assuming that cognitive appraisals are important antecedents of emotions, the question arises, what accounts for a situation being appraised in a certain way? In sum, appraisals reside in individuals and their personal beliefs (i.e., predispositions, biases, schemas, etc.). These personal beliefs provide a lens through which individuals perceive their environment, and thus strongly influence how they interpret a situation. The CVT's social-cognitive basis implies that the social environment, as perceived by individuals, plays an important role in shaping their control and value appraisals pertaining to a particular achievement situation. Specifically, Pekrun (2006, 2018) describes a number of environmental factors relevant for achievement emotion appraisals, including (1) facets of instruction, including cognitive quality and task demands, (2) value induction, (3) autonomy support, (4) goal structures and expectations, and (5) achievement, both actual levels and the corresponding feedback and consequences (see Figure 1). There is extensive empirical evidence showing links between those environmental factors and students' emotions. The mediating role of control and value appraisals has also been consistently demonstrated. For example, Lazarides and Buchholz (2019) provided robust evidence on the links between facets of student-perceived instructional quality pertaining to teacher support and classroom management, and students' achievement emotions. Further, Flunger et al. (2019) provided compelling evidence from a field experiment, showing that if physics teachers taught a standardized teaching unit on heat transfer with significant autonomy support (by providing choices, rationales, and general

information in a noncontrolling language) instead of using regular teacher-centered instruction, students experienced more positive achievement emotions, and fewer and less intense negative emotions. There is also consistent evidence that classroom goal structures are systematically linked to students' emotions (e.g., anger, anxiety, and shame showing positive links with performance goal structures, and boredom showing negative links with mastery goal structures; see e.g., Baudoin and Galand, 2017).

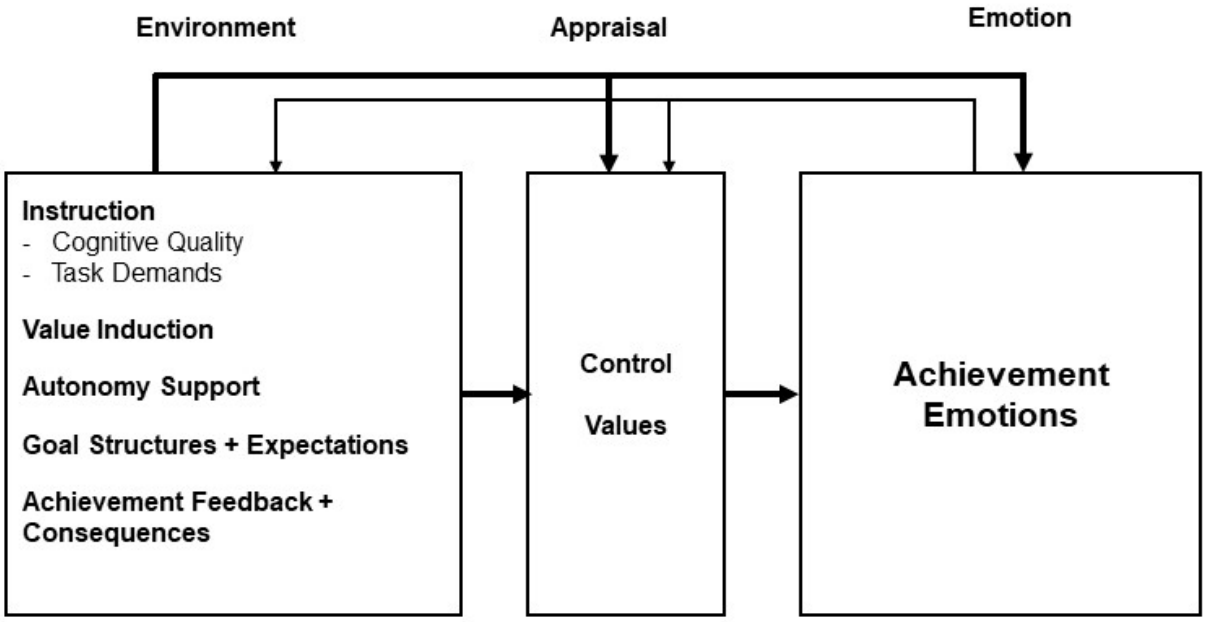

Figure 1 The control-value theory related to the antecedents of achievement emotions: Reciprocal linkages between antecedents and emotions. Adapted from Pekrun, R. (2006) The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review* **18**, 315–341. https://doi.org/10.1007/s10648-006-9029-9

Figure 1 summarizes the main propositions of the CVT related to antecedents of emotions. Importantly, even though this theory is rooted in appraisal theory and thus primarily proposes that environmental factors predict cognitive appraisals, which in turn predict emotional experiences, it also acknowledges that emotions are reciprocally linked to their cognitive antecedents (Goetz et al., 2021). This reasoning is reflected in the recursive arrows included in the model (Pekrun, 2006, 2018).

3 Relevance of Emotions for Learning and Performance

3.1 Relevance of Emotions for Students

In applied, field-based educational and psychological research, emotions, motivation, behavior, and achievement outcomes are typically gauged together, often through self-reports, and often targeting specific domains, such as math or languages. There is substantial evidence demonstrating that emotions and achievement outcomes are systematically linked. Researchers have proposed that the link between achievement emotions and learning outcomes may be mediated by a range of cognitive, motivational, and self-regulatory processes (Pekrun, 2006, 2018).

Indeed, there is consistent evidence showing that negative emotions including anxiety, shame, anger, boredom, or hopelessness during learning are related to unfavorable cognitive processes that include task-irrelevant thinking, shallow learning strategies, or less sophisticated metacognitive strategies. Conversely, enjoyment of learning relates negatively to irrelevant thinking, and positively to a better task focus and more effective self-regulation of learning (see e.g., Ahmed et al., 2013; Obergriesser and Stoeger, 2020).

Research, describing links between achievement emotions and achievement motivation during learning, is also ample. For example, studies have demonstrated that positive emotions and mastery goals (specifically, mastery approach goals) were positively linked (see Huang, 2011, for a meta-analysis). Similarly, positive emotions, and enjoyment in particular, are key drivers and an inherent component of intrinsic motivation (Isen and Reeve, 2005). Conversely, negative emotions (e.g., anxiety, boredom, and anger) may focus students on consequences of their potential failure at the task or the unpleasant nature of the task, and are thus linked with less self-determined types of motivation. It is worth noting, however, that research on achievement emotions and on intrinsic versus extrinsic motivation has rarely been integrated (for exceptions, see e.g., González et al., 2012; Sutter-Brandenberger et al., 2018).

A number of studies has also explored the overall relations between achievement emotions and achievement. There is consistent evidence that these relations are generally positive for pleasant/positive emotions, and negative for unpleasant/negative emotions (for an overview, see Goetz and Hall, 2020; for meta-analytic evidence, see Camacho-Morles et al., 2021; Hembree, 1988; Loderer et al., 2020; Tze et al., 2016; Zhang et al., 2019). Recent studies examined these links by employing longitudinal designs, and their findings indicated that the observed correlations were driven by reciprocal effects between emotions and academic

performance (Forsblom et al., 2022; Pekrun, Lichtenfeld, et al., 2017; Putwain, Pekrun, et al., 2018; Putwain et al., 2022). Although there is evidence supporting contingencies of 'pleasant = beneficial for performance' and 'unpleasant = detrimental for performance', these links may be considerably more nuanced. For example, Pekrun (2006, 2018) suggested a further differentiation between activating (i.e., anger, enjoyment) and deactivating achievement emotions (i.e., hopelessness and boredom), resulting in a 2-by-2 taxonomy. According to this reasoning, typically positive effects are expected for pleasant and activating emotions such as enjoyment and pride, and clear-cut negative effects are expected for negative-deactivating emotions. Effects on academic achievement are, in contrast, expected to be more variable "for both deactivating positive emotions, such as relaxation, and activating negative emotions, such as anxiety" (Pekrun, 2006, p. 326). However, for many emotions the evidence for these hypothesized emotion-achievement links is still scarce and in need of further exploration. Notable exceptions are enjoyment, anxiety, and boredom, with a substantial body of research accumulated for these emotions (Camacho-Morles et al., 2021; for confusion see D'Mello et al., 2014; for shame see Turner and Schallert, 2001). So, on average, students' enjoyment of learning is positively correlated with their academic achievement, whereas correlations for anxiety and boredom are negative (Barroso et al., 2021; Camacho-Morles et al., 2021). Anxiety can be both beneficial and detrimental for performance; however, it remains controversial if the anxiety-performance relation follows an inverted U-shaped form for academic learning. For high levels of anxiety, negative linkages with achievement are expected (for evidence, see e.g., Sung et al., 2016).

In sum, there is compelling evidence demonstrating that emotions influence academic achievement and vice versa. In fact, emotions, cognitions, motivation, learning behaviors, and achievement mutually affect each other. More research on the complex links among these variables is needed (e.g., for links between emotions, appraisals, and achievement, see Forsblom et al., 2022).

3.2 Relevance of Emotions for Teachers

Historically, the focal point of research on emotions in the context of education has been on the learner. Although it has long been acknowledged that teaching is a social and highly emotional practice (D'Eon et al., 2000; Goldstein and Lake, 2000; Hargreaves, 1998; Nias, 1996), research on teachers' emotions has been predominantly descriptive and far less systematic. Recently however, research focusing on teachers' psychological characteristics, including their emotions, has been steadily growing. As with students' emotions, appraisal theory has been

proposed to be a meaningful framework for the study of teacher emotions (e.g., Chang, 2009; Fried et al., 2015; Tsouloupas et al., 2010). Appraisal theory is also at the heart of Frenzel and colleagues' reciprocal model of causes and effects of teacher emotions (Frenzel, 2014; Jacob et al., 2017; see Figure 2). In line with Butler (2007), who argued that "the school is an achievement arena not only for students but also for teachers who presumably strive to succeed at their job" (p. 242), Frenzel (2014) proposed that teachers' appraisals concerning their successes or failures regarding their teaching goals were key to understanding the antecedents of teacher emotions. The researchers showed that those teachers who perceived themselves or their teaching as contributing to high student motivation, discipline, and high-quality teacher-student relationships also reported more enjoyment and less anxiety and anger, and that those links were also reflected when examined at the within-person level (Frenzel et al., 2020). That is, teachers' enjoyment of teaching was higher when students performed better, were motivated and disciplined, and when they perceived they had better relationships with their students.

Further, it can be assumed that teachers' emotions, due to their effects on motivation, decisions (e.g., choice of teaching strategy), and mental flexibility, in turn, affect their teaching. Studies revealed that teacher emotions were linked with how well teachers activated their students cognitively and motivationally, how well they succeeded in classroom management, and how well they supported their students socially and emotionally. As a result, recent findings showed that teachers' emotions were systematically related to student outcomes (see Frenzel et al., 2021, for a review, and see Pekrun, 2021b, for discussion). Specifically, teachers' pleasant emotions have been consistently linked with student motivation, enjoyment of learning, self-regulation, and performance (Babad, 2007; Banerjee et al., 2017; Beilock et al., 2010; Frenzel et al., 2016; Keller et al., 2016), and teachers' unpleasant emotions have been linked with undesirable student outcomes including disruptive behavior, anxiety, and reduced performance (Aldrup et al., 2018; Arens and Morin, 2016; Chang, 2013; Klusmann et al., 2016).

In general, instructional behavior and teachers' emotions have important effects on learners. This results in positive or negative cycles of teachers' emotions, their teaching behavior, and student outcomes. When considering emotions, it becomes evident that educational psychological research can benefit from moving beyond seeing the teacher as the key effect-exerting factor driving student outcomes. As much as teachers affect students, the reverse is also true: Students' individual or class-level characteristics, including their own emotional experiences, level of prior knowledge and performance, motivation, discipline, and their attitude

towards the teacher, can also affect teachers and their emotional well-being (Frenzel et al., 2021; Nurmi and Kiuru, 2015).

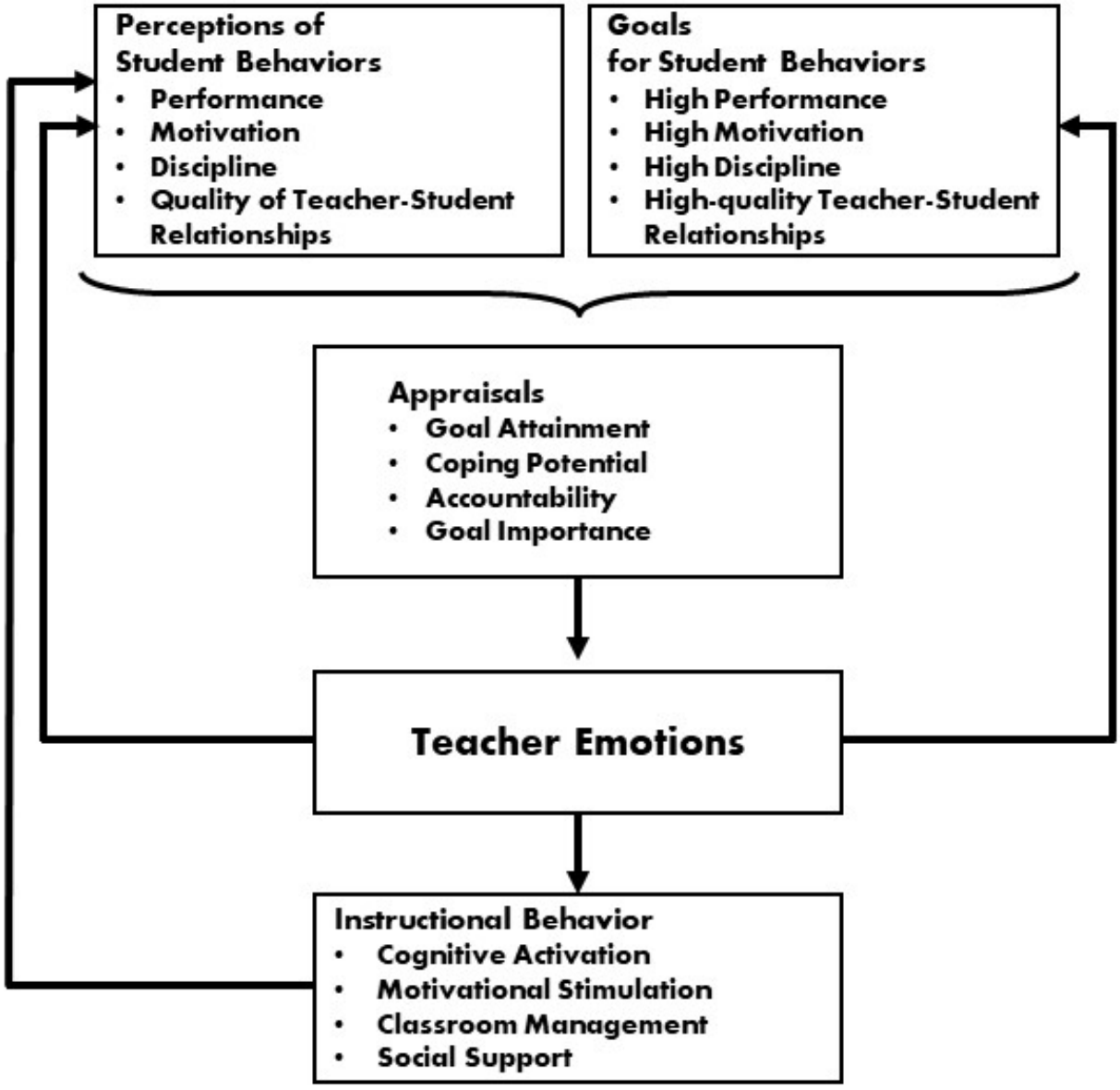

Figure 2 The reciprocal model of causes and effects of teacher emotions (Frenzel, A. C., Pekrun, R., Goetz, T., Daniels, L. M., Durksen, T. L., Becker-Kurz, B. and Klassen, R. (2016). Measuring enjoyment, anger, and anxiety during teaching: The teacher emotions scales (TES). *Contemporary Educational Psychology* **46**, 148–163. http://dx.doi.org/10.1016/j.cedpsych.2016.05.003). Figure available at https://doi.org/10.6084/m9.figshare.14493789.v2, under CC license (https://creativecommons.org/licenses/by/4.0/)

When it comes to mutual influences between teachers' and students' emotions, research on social interaction has shown that people can 'infect' each other emotionally (Elfenbein, 2014; Hatfield et al., 1994; Parkinson, 2011). Studies by Frenzel and colleagues (Frenzel et al., 2018; Frenzel et al., 2009) provided initial support for the transmission of enjoyment between mathematics teachers and their students. In a longitudinal study, the authors showed that emotional transmission was based on the mutual perception of behavior in the classroom (Frenzel et al., 2018). That is, positive effects of teachers' joy on students' joy were mediated by the perceived enthusiasm of teachers, and positive effects of students' joy on teachers' joy were mediated by the perceived motivational commitment of students. Similarly, Moskowitz and Dewaele (2019) showed that there are links among students' perceptions of their language, teachers' happiness, and motivation towards learning English. Using experience sampling methods, Poon et al. (2019) showed that teachers' nervousness is associated with higher subsequent levels of nervousness and irritability among students, which, in turn, impairs students' in-class satisfaction.

As such, it is imperative to consider not only students', but also teachers' emotional experiences in the context of learning and teaching. These variables represent important psychological outcomes in their own right, but they are also linked with academically meaningful cognitive outcomes, that include instructional quality and student achievement, and they are reciprocally linked with each other.

4 Designing Emotionally Healthy Learning Environments

A key implication of the empirical findings and theoretical contentions presented in this chapter is that it is not enough to consider only achievement outcomes, 'cool cognitions', instructional ideals, or didactic techniques when designing learning environments. Educators should also tailor instructional design towards optimizing teachers' and learners' affective outcomes as critical preconditions for personal success and well-being. Such contentions have also been supported by advocates of social-emotional learning (SEL) programs who emphasize the importance of focusing on social and emotional development of students, in addition to their cognitive development (for a meta-analytic review showing that SEL programs also positively affect student achievement, see Corcoran et al., 2018, and Murano et al., 2020; for further reading, see Weissberg et al., 2015). Below we outline some ideas on how learning environments can be optimized, taking teachers' and students' emotional experiences into account. These ideas are inspired by the literature on achievement motivation and emotions (e.g., Pekrun's CVT, 2006,

2018, 2021a), emotion regulation, and SEL. These research traditions have operated in relative isolation, but they tend to converge in their implications as to how learning environments can be emotionally optimized.

4.1 Influencing Students' and Teachers' Emotional Experiences During Classroom Instruction

4.1.1 Promoting enjoyment of learning in the classroom

As emphasized by Linnenbrink-Garcia et al. (2016), in order to optimize the emotional tone in the classroom, students' enjoyment of learning should be deliberately fostered. An effective way to promote enjoyment and interest in the instructional content is to implement personally relevant and active tasks, for example, by situating lessons in the context of real-world applications of interest to students, and by allowing them to engage with study materials across various settings (Design Principle 3 suggested by Linnenbrink-Garcia et al., 2016). It is worth noting, however, that focusing on boosting students' mood and cheerful atmosphere is not enough to promote learning. It is far more important to realize that student attention and effort is more likely to be sustained when learning is enjoyable.

4.1.2 Supporting students' feelings of competence, enhancing autonomy, emphasizing learning, and de-emphasizing social comparison

These are design principles suggested by Linnenbrink-Garcia et al. (2016) that are of relevance to the control component of Pekrun's CVT. Students will tend to feel more in control over their learning activities and achievement outcomes when they feel competent in those tasks. The perception of mastery can be achieved by offering well-structured, reasonably paced, and clear instruction, and by implementing optimally challenging tasks at, or just slightly above, students' current skill levels. Students' feelings of autonomy can be supported with ample opportunities for student decision-making, and minimizing the use of extrinsic awards and practices that make students feel they are being controlled (e.g., avoiding telling them where to sit, or when to speak; Reeve, 2009). The potentially controlling nature of extrinsic rewards, however, may be employed to establish an initial level of motivation, but autonomy and agency should be subsequently fostered. Additionally, fostering mastery goals and taking focus away from performance goals is another key design principle for emotionally healthy classrooms. Despite the fact that many students enjoy competition, social comparison should not be sustained. In other words, games and activities that presuppose a single winner make success a scarce resource in the classroom, and suggest that success is limited to very few individuals (see Pekrun

et al., 2019). Hence, this kind of instructional arrangement is not conducive to positive emotional classroom climate.

4.1.3 Optimizing learners' and teachers' emotional experiences by supporting mutual feelings of relatedness

As their fifth design principle for adaptive motivation and emotion in education, Linnenbrink-Garcia et al. (2016) suggested supporting students' feelings of relatedness and belonging. This notion can be extended to teachers' emotions and motivation as well. Students report enhanced interest and reduced negative affect when the perceived quality of teacher-student relationship is high (Goetz, Keller et al., 2020; Quin, 2017; Roorda et al., 2011). Similarly, the more connected teachers feel to their students, the higher their emotional well-being is shown to be (e.g., Klassen et al., 2012; Spilt et al., 2011). Feelings of relatedness between teachers and students can be promoted by spending nondirective one-on-one time (also referred to as 'banking time'; cf. Driscoll et al., 2011; Pianta and Hamre, 2001) or by enhancing perceptions of mutual similarity (Gehlbach et al., 2012). The latter intervention involved having students and teachers complete a 'get-to-know-you questionnaire' at the beginning of the school year, and then providing teachers with information about preferences or attitudes they shared with half of the students in their classes (randomly selected; the other half of the students were the control group). Teachers reported improved relationships with those students for whom they had received similarity information five weeks later.

4.2 Optimizing Test-Taking and Feedback

The design of tests and assessments, the feedback provided after testing, and the consequences of individuals' performance influence students' emotions (Pekrun, 2006). If the structure, demands, and consequences of assessments are not clear to students, test anxiety is increased due to the possibility of failure. Further, tests that demand high attention can impair performance in students who are anxious about tests, because part of their cognitive resources are already consumed by worrying about failure. Anxiety can be further increased during such tests. This may be true, for example, when creative essay writing has to be carried out in a limited period of time.

Feedback about achievement on academic tests is one of the most powerful factors in the development of achievement emotions (Goetz et al., 2018). Repeated feedback on success can strengthen students' self-confidence and cultivate self-efficacy over time and increase their positive achievement emotions, such as hope for success and pride. In contrast, repeated feedback

on failure undermines self-confidence and increases negative achievement emotions, such as anxiety, shame, and hopelessness. This is especially true if feedback on failure is coupled with the message that failure is due to lack of ability as opposed to students' lack of investing time and effort. Regarding feedback on achievement, teachers can strengthen students' self-confidence and positive emotions by using the following four principles (Pekrun, Muis et al., 2017). (a) Whenever possible, mastery standards should be used and normative standards should be avoided for evaluating achievement. (b) Repeated feedback on success rather than on failure should be used by emphasizing improvement of performance, even if improvement is small. (c) Modeling adaptive approaches to dealing with failure has a vast instructional value. It is important to make clear to students that errors and mistakes should be regarded as opportunities to learn, and that abilities are malleable (e.g. by assigning the grade "not yet" instead of "fail"; Dweck, 2010). (d) Beyond evaluative feedback about success and failure, it is critical to provide formative feedback about how students can improve their competencies and attain mastery. Detailed formative feedback, combined with positive expectancies of mastery, will strengthen students' confidence in their abilities, and will support positive affective outcomes resulting from such confidence.

4.3 Supporting and Fostering Adaptive Emotion Regulation

Even if educators put forth their very best efforts to engage themselves and their learners and create emotionally sound environments for learning and teaching, negative emotions are bound to be experienced. These are inevitable because of heterogeneity in the classroom with respect to intelligence, prior knowledge and interest, as well as with respect to emotional dispositions of teachers and students alike (e.g., habitual enjoyment, test anxiety). As such, students and teachers need to have a range of strategies for regulating learning- and teaching-related emotions. There are numerous models and approaches describing the emotion regulation of students and teachers as well as effective coping strategies that enable individuals to downregulate their negative emotions (e.g., Burić et al., 2016; Donker et al., 2020; Harley et al., 2019; Jarrell and Lajoie, 2017; Lee et al., 2016).

Emotions can be regulated by directly changing their symptoms (emotion-oriented regulation) or by changing their antecedents (competence-, situation-, and appraisal-oriented regulation; Pekrun, Muis, et al., 2017). Successful emotion regulation presupposes abilities to recognize one's emotions and to select appropriate ways of managing them. These abilities are part of an individuals' emotional competencies, which consist of abilities to recognize, make use of, and regulate one's own emotions and the emotions of other persons (e.g., Goetz and Bieg,

2016). There are several ways in which emotion regulation can be trained in the classroom. For example, teachers can model emotion regulation by first labeling, identifying, and reframing their own emotions. SEL programs can be used to help students practice these skills. An example of a very popular SEL program, which focuses on fostering emotional intelligence, is the PATHS program (Promoting Alternative Thinking Strategies; Greenberg et al., 1995; for a description of the program, see also Brackett and Rivers, 2014; Parker et al., 2009). A model for the Promotion of Emotional Intelligence in Learning and Achievement Situations (the PEILAS Model) is outlined by Goetz and Bieg (2016).

When it comes to the regulation of specific emotions, the most prominent emotion is test anxiety, reflecting the long tradition of test-anxiety research (Zeidner, 1998). Programs focused on dealing with test anxiety target specific symptoms of anxiety (e.g., relaxation training), lack of self-confidence causing anxiety (e.g., cognitive therapy), or underlying competence deficits (behavioral skills training; e.g., training to improve learning strategies). Combinations of these approaches have been shown to be most effective for many students. In sum, theoretical and empirical findings suggest that there are numerous ways to design emotionally healthy learning environments for teachers and students alike. It is important to create instructional situations and contexts in such a way that students, who typically spend a large and important part of their lives in them, would experience a preponderance of positive emotions. After all, the joy of learning will undoubtedly contribute to positive academic outcomes and students' general sense of well-being. Hence, we implore researchers to continue on their path toward better understanding of links and contingencies between emotions and other meaningful variables.

5 Conclusion

In this chapter, we introduced emotions as multidimensional constructs with affective, cognitive, motivational, physiological, and expressive components. Based on traditional appraisal-theoretical approaches, it can be assumed that emotions arise from individuals' subjective evaluation of activities and outcomes. In the context of learning and performance, control and value appraisals are of particular importance. This evaluation is influenced by personal beliefs, but also by external circumstances. Thus, teachers have the opportunity to shape the emotional experience of students through targeted designs of learning environments and learning tasks. Emotions impact a range of cognitive, self-regulatory, and motivational processes, and, subsequently, student performance and learning. Moreover, they are important components of individuals' subjective well-being. Therefore, promoting positive emotions and reducing

negative emotions in school and out-of-school learning should also be a meaningful goal and educational outcome. However, not only the emotions of students, but also those of teachers are critical to consider. After all, it's the teachers' emotions that may affect the quality of instructional processes and contribute to teachers' subjective well-being. Ultimately, it is rewarding for teachers to work with students who are filled with joy of learning and interest in the learning content, and schooling experience is more favorable for students who interact with enthusiastic and warm teachers.

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