

**Research on Situated Motivation and Emotion:  
Progress and Open Problems**

Reinhard Pekrun<sup>1,2,3</sup> and Herbert W. Marsh<sup>2,4</sup>

<sup>1</sup>Department of Psychology, University of Essex, Colchester, United Kingdom

<sup>2</sup>Institute for Positive Psychology and Education, Australian Catholic University,  
Sydney, Australia

<sup>3</sup>Department of Psychology, University of Munich, Munich, Germany

<sup>4</sup>Department of Education, Oxford University, Oxford, United Kingdom

*Learning and Instruction*, 2022, Vol. 81: 101664.

Copyright held by Elsevier. This article may not exactly replicate the authoritative document published in the journal. It is not the copy of record. Link to the final article: <https://doi.org/10.1016/j.learninstruc.2022.101664>

**Author Note**

Reinhard Pekrun  <https://orcid.org/0000-0003-4489-3827>

Herbert W. Marsh  <https://orcid.org/0000-0002-1078-9717>

Correspondence concerning this article should be addressed to Reinhard Pekrun, Department of Psychology, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, United Kingdom. E-Mail: [pekrun@lmu.de](mailto:pekrun@lmu.de)

**Abstract**

Research on situated motivation and emotion in education has made substantial progress, as documented in the contributions to this special issue. I discuss how we can make further headway in this field. First, I address the ambiguous meaning of the term situation and propose a  $2 \times 2$  model of situational variation across time and context. From this model, it follows that we should consider study designs that address not only variation over time and single settings, but also across broader socio-cultural contexts. I then explain the need to overcome the current fragmentation of theoretical models by integrating constructs and theoretical propositions. Next, I discuss strategies to improve methodology, including further development of empirical paradigms, analyzing the equivalence of effects across levels and persons, and use of dynamic modeling of data from different sources. Finally, I argue that we need to broaden research perspectives by developing formalized micro- and macro-theories; considering motivation and emotion beyond the achievement domain; including samples from non-WEIRD countries; and investigating the generalizability of principles and practices across persons, cultural contexts, and historical times.

*Keywords:* Achievement emotion; achievement motivation; control-value theory; expectancy-value theory; within-person research

Motivation and emotion are situated in time and context. Traditionally, educational research has neglected the dynamic and context-dependent nature of emotional and motivational processes, in part due to lack of suitable methodologies. Instead, researchers focused on investigating motivation and emotion using trait-like constructs. Prime examples are research on students' achievement motivation and their test anxiety. Today, dynamic measures and modeling approaches make it possible to investigate emotion and motivation as momentary processes in a given context.

The contributions to this special issue document how the use of such measures and analytic strategies can advance our knowledge about motivation and emotion in education. Based on experience sampling methodology (ESM), all seven articles add unique new evidence that has been lacking. Most importantly, in addition to using traditional between-person analytic perspectives, all seven studies employed within-person study designs and within-person modeling approaches, including multilevel modeling and network analysis. Findings based on these methodologies allow to infer conclusions about within-person relations between motivation, emotion, their origins, and critical outcome variables.

Four of the articles focused on relations among constructs of motivation and emotion as well as relations with outcomes. Krannich et al. (2022) report that students' perceptions of non-optimal challenge were positively related to their boredom in mathematics, and that both non-optimal challenge and boredom were negatively related to their aspirations in this domain. Neubauer et al. (2022) showed that students' daily achievement goals were linked with their daily experiences of success and failure, with goals serving both as antecedents and outcomes of these experiences. Moeller et al. (2022) propose to use principles of dynamic systems theory to integrate existing theories and to explain functional relations between states and traits. In an empirical study, they found systematic within-person relations between different types of students' expectancies and values. Using network analysis, Tamura et al.

(2022) examined the within-person relations of more than 30 motivational and emotional variables. Perceived competence, interest, and intrinsic motivation formed one major cluster of constructs, and positive and negative emotions another major cluster.

Three of the studies targeted variation in students' perceptions of tasks and classroom instruction. Laying the groundwork for a within-person analysis of perceptions of instruction, Talic et al. (2022) found that these perceptions showed considerable within-person variation over time, and that they were similarly structured across different school subjects. Wieland et al. (2022) report that students' perceptions of the ambiguity of tasks explained the variation in their procrastination over the days before an exam. Finally, Bieg et al. (2022) found that students' perceptions of the enthusiasm and humor displayed by teachers related positively to their enjoyment and negatively to their boredom, thus documenting the importance of teachers for students' emotions.

Taken together, the seven studies demonstrate that students' motivation and emotion show considerable within-person variation across situations, thus documenting the crucial importance of attending to the role of the situation. Furthermore, they confirm important links between affective constructs and variables of tasks, classroom instruction, achievement behavior, and aspirations. Furthermore, an important finding from several of the studies is that within-person relations were largely equivalent to the between-person relations between the same variables, thus attesting to generalizability across levels (Krannich et al., 2022; Neubauer et al., 2022; Talic et al., 2022; Wieland et al., 2022; see Section 3 for discussion).

Based on these contributions, how can we make further headway in research on situated motivation and emotion? I will first discuss the meaning of the term situation. Next, following up on the contributions by Moeller et al. (2022) and Tamura et al. (2022), I address the need to integrate theoretical approaches to overcome the current fragmentation of research in the field. I then discuss methodological issues that are crucial to investigate the impact of

situation, including study designs that consider variation across both time and contexts, dynamic measures using multiple channels, and modeling approaches that integrate within- and between-person perspectives. Finally, I address strategies to further expand existing perspectives: developing formal theories; targeting constructs beyond the achievement domain; considering teachers, parents, and administrators; investigating generalizability; and including cultural contexts beyond Western countries.

## **1. What is a Situation?**

### **1.1 The Double Meaning of Situation**

From early on, personality theorists argued that behavior is a joint function of person and situation (e.g., Lewin, 1935). However, adequately conceptualizing the role of situations is not an easy task. At the core of this task is an understanding of the term situation.

Unfortunately, as the term is used both in everyday language and in research, it has multiple meanings. Maybe most importantly, the term can be used to denote different points in time, or to denote different types of contexts.

Time and context are two different dimensions. They can vary independently from each other, implying that all combinations are possible. To simplify the discussion, let us just consider variation versus non-variation in each of them, without considering different degrees of variation. Given independence, this renders four combinations, which are represented in four types of empirical approaches (see Table 1).

(1) Same time, same context. Assessing variables at one point in time, within one specific context, is the classic procedure of many cross-sectional studies. From these studies, we cannot infer any strong conclusions about the influence of time and context, nor about the causal links between variables.

(2) Different times, same context. Variation of time but not context means that the same situation (as defined by context) is repeated over time. Certainly, Heraclitus' dictum

holds that you cannot step in the same river twice – the river will not be exactly the same the second time. This view implies that there is no variation in time without variation in context – as time passes, the context necessarily changes as well. However, Wittgenstein's (1953) reply also holds – if you engage in another language game and disregard changes that are not relevant, then it is still the same river. Similarly, an achievement situation, such as attending a math class, can be the same next time in terms if relevant parameters such as difficulty or support from the teacher remain the same. In such a case, there is variation of time, but little variation in context. Many studies using ESM are located in this category.

(3) Same time, different contexts. Conversely, it is possible to consider differences between contexts that exist at the same time. For example, at a given point in time, some teachers may teach students in China how to read and write, while others instruct Australian students – two different socio-cultural contexts. In this case, there is variation of contexts but not time. Many comparative studies, such as one-shot cross-cultural investigations, fall into this category.

(4) Different times, different contexts. Finally, it is possible to consider both variation over time and across context. For example, if we assess students' emotions using ESM across days and weeks with random sampling of events over the whole day, then we catch both variance over time points and different contexts (e.g., Goetz et al., 2010). In contrast to the first three options, such a study could be considered as more fully investigating the role of situation, especially if variation of the broader socio-cultural context (e.g., culture) is addressed as well.

## **1.2 Implications: Studying Situated Motivation and Emotion**

From the above classification, it follows that situatedness can be defined in terms of time, context, or both. In terms of temporal variation versus generality, states (time-variable) can be distinguished from traits (relatively time-stable). In terms of variation across contexts,

context-specific variables can be distinguished from context-general constructs. Given independent variation of time and context, this renders four types of motivational and emotional constructs. Often only two of them are considered – states that occur in a given, specific context, and traits that are domain-general. However, there are states that are not bound to a specific context, such as free-floating anxiety that persists regardless of the situation, and traits that are situation-specific, such as trait math anxiety. From this perspective, research on domain-specific motivation and emotion, such as students' anxiety and motivation in math, can be considered as situated, even if assessing traits.

The studies documented in this special issue represent important advances over case #1, the classic cross-sectional design, and over the study of domain-general traits. All of them considered variation in time, as well as variation in context in terms different school subjects, lectures, or tasks. However, all of them were situated in the same broader Western social-cultural context, implying that variation of the context was limited. It is an important avenue for future research to more fully consider variation in both time and contexts (see also Nolen, 2020). In other words, using terms from Bronfenbrenner's (1979) social-ecological perspective, it would be important to also consider the influence of meso- and macro-systems, beyond variation in the microsystem.

## **2. Theory Development: Overcoming Fragmentation**

Research on situated motivation and emotion is plagued by the diversity of constructs and theoretical approaches, as noted by Moeller et al. (2022) and Tamura et al. (2022). Some of the articles in this special issue use Eccles's and Wigfield's (2021) expectancy-value theory or my control-value theory (Pekrun, 2006, 2018, 2021). These two approaches focus on the functions of specific cognitions (such as control, expectancy, and value) for motivation and emotion, respectively. Both theories also consider situational conditions in learning environments and the broader socio-cultural context. Other theories focus on explaining the

development of motivational and emotional cognitions, such as Marsh's models of self-concept development (e.g., Marsh et al., 2018), or self-determination theory explaining the generation of value through need fulfillment (Ryan & Deci, 2017). A third strand of theoretical models focuses on the effects of emotion and motivation, such as theories addressing the impact of emotions on decision making, problem solving, and memory processes (Pekrun & Linnenbrink-Garcia, in press), or achievement goal theories explaining the influence of achievement motivation on behavior and performance (Elliot et al., 2017).

These theories represent different research traditions. They are fragmented and lack integration, which hinders both scientific progress and communication with practitioners. To better understand emotion and motivation in education, and the role of situations, models integrating perspectives from different theoretical approaches are needed. For constructing such models, it is not sufficient to simply add up propositions from different theories. Rather, it would be necessary to conceptually synthesize theories. This task involves two challenging steps: Overcoming jingle-jangle fallacies by eliminating conceptual redundancy, and integrating propositions.

## **2.1 Jingle-Jangle Fallacies**

To integrate theories, it is necessary to first examine conceptual equivalence of constructs, and to establish equivalence if needed. We need to disentangle the many existing jingle-jangle fallacies in the field – different terms being used to denote the same construct, and the same term being used for different constructs. For example, to what extent are self-efficacy expectations (Bandura, 1977), agency beliefs (Skinner, 1996), action-control expectations (Pekrun, 2006), and self-concept of ability (Marsh et al., 2018) the same (a classic jingle fallacy)? On a more general level, to what extent are emotion and motivation the same – are these two constructs distinguishable?



Conceptual and empirical work is needed to answer these questions. From a conceptual perspective, clear definitions of constructs are needed to overcome jingle-jangle fallacies. Among various approaches to define constructs, definition by the common core of existing usages of a term may be most fruitful to advance communication (Pekrun, 2019). Taken the relation between emotion and motivation as an example, and using the common core approach, how could we answer the question whether the two are the same or not?

From a common core perspective, *emotions* can be defined as coordinated sets of processes in response to important events (Scherer & Moors, 2019). These processes can include affective, cognitive, motivational, physiological, and expressive components. An example is uneasy, nervous feelings (affective), worries about possible failure (cognitive), avoidance motivation (motivational), arousal (physiological), and anxious facial expression (expressive) in anxiety before an exam. *Motivation* can broadly be defined as psychological forces that shape the goal direction, intensity, and persistence of behavior, such as students' achievement goals influencing their achievement behavior (Pekrun, in press a).

From these two definitions, it follows that emotion and motivation overlap, but that they are not the same (Pekrun, in press b). Emotions often comprise motivational impulses to act, such as fight and flight in anger and anxiety, respectively. However, this is not always the case. Pleasant enjoyment of a sunny day does not need to entail motivation for any specific action. Conversely, motivation can comprise strong emotions. However, again, this is not always the case. For example, motivation can be based on non-emotional, physiologically based feelings such as hunger and thirst. Moreover, motivation can comprise "cold," emotionally neutral calculation of benefits and costs, without involvement of any more intense feelings.

The conceptual relations between constructs have important ramifications for assessment and intervention. Again, the relation between emotion and motivation is a good

example. If emotion can comprise motivation, and motivation can comprise emotion, then there is construct overlap, and measures of emotion and motivation may overlap as well. Students' enjoyment and intrinsic motivation are a case in point. Measures of enjoyment such as the enjoyment scales of the Achievement Emotions Questionnaire (AEQ; Pekrun et al., 2011) comprise motivational items (e.g., "Certain subjects are so enjoyable that I am motivated to do extra readings about them"), and measures of intrinsic motivation often comprise emotion items. Using these measures to examine links between emotion and motivation may render correlations that are, in part, tautological.

For intervention, given the overlap, it is important to consider the impact of emotion interventions on motivation, and the impact of motivation interventions on emotion. These side effects of interventions may be beneficial, but this may not always be the case. For example, if a motivation intervention boosts students' valuing of achievement, then the intervention may strengthen their achievement motivation, but also increase their anxiety.

In addition to conceptual analysis, empirical work can be helpful. Even if constructs are separable from a conceptual perspective, they may still be inseparable empirically (see, e.g., Marsh et al., 2019, for self-efficacy and self-concept). Different methods are available for this purpose, including factor-analytic modeling and network analysis as used by Tamura et al. (2022). If empirical work leads to the conclusion that constructs cannot be separated empirically, then there are two possible conclusions: We should either merge the constructs or develop better measures that show discriminant validity.

Based on such conceptual and empirical work, it should be possible to better organize the conceptual space of emotion and motivation, reduce the multitude of overlapping terms, and arrive at more precise definitions and measures. For example, do we need more than 100 overlapping terms denoting constructs of control as they existed already in the 1990s

(Skinner, 1996)? Likely not. For integrating theories, we need to better organize the conceptual space used to build theories.

## **2.2 Integrating Theoretical Propositions**

Beyond clarifying constructs, propositions from different theories could be integrated to overcome fragmentation. Fortunately, most theories of emotion and motivation are sufficiently equivalent, or at least complementary, to make this possible. Contradictory propositions are the exception rather than the rule. Integration is especially promising when the same set of constructs is addressed in different theories. However, caution should be exerted to make sure that important differences are not lost in the process of integration.

An example for both similarities and differences are control-value theory (CVT; Pekrun, 2006, 2018, 2021) and expectancy-value theories (EVTs). Both CVT and EVT use concepts of expectancies and values. CVT has similarities with EVT such as Heckhausen's (1991) model, Raynor's model of future-oriented motivation (Raynor & Roeder, 1987), Eccles's and Wigfield's (2021; Wigfield & Eccles, 2000) theory, and EVT of work motivation (Pinder, 2008). CVT represents an extension of the expectancy-value model of anxiety I have proposed earlier (Pekrun, 1992), and is conceptually aligned with an expectancy-value model that integrated classic EVT reasoning with Bandura's self-efficacy theory (Pekrun, 1988, 1993). The similarity between CVT and EVT extends to the algebraic formulation of relations between expectancies and value, with interactive terms explaining effects of emotions and motivation, respectively (Nagengast et al., 2011; Shao et al., 2020).

However, there also are important differences. CVT targets emotions; EVT explain motivation. Because CVT targets emotions, it considers various kinds of appraisals. Expectancies can be defined as prospective cognitions that represent forward temporal relations between intention, action, and outcomes (Pekrun, 2006). As such, expectancies are suited to explain motivation, and they are suited to explain prospective emotions like hope for

future success or fear of failure. However, they are not well suited to explain concurrent emotions that are experienced during achievement activities, such as enjoyment of learning or boredom during lectures. Similarly, they are less helpful to explain retrospective emotions following achievement outcomes, such as pride about success and shame about failure.

For activity emotions, CVT proposes that self-concepts of ability are especially important, in addition to value. These self-concepts comprise judgments of ability rather than cognitions of temporal relations. As such, they differ from expectancies, even if related measures tend to be correlated (Marsh et al., 2019). For retrospective emotions, cognitions about retrospective temporal relations are important, such as retrospective causal attributions of success and failure (Weiner, 1985). For epistemic, social, or health-related emotions, further appraisals need to be considered, such as appraisals of cognitive incongruity (Pekrun, 2021).

Given partial overlap, it might be possible to integrate some but not all of the propositions of CVT and EVTs. Similarly, theories of the effects of motivation and emotion on important outcomes can, in part, be integrated conceptually. For example, different theories on the effects of emotional valence and arousal on cognitive processes share core propositions (Pekrun & Linnenbrink-Garcia, in press). Exploring overlap and integrating theories to reduce redundancy while keeping the explanatory breadth of each of them is an important task for future research on situated motivation and emotion.

### **3. Methodological Paradigms**

#### **3.1 Study Designs Targeting Time and Context**

As argued earlier, situatedness can be defined as being located in time and context. From this perspective, all types of studies can be considered as situated. This is even true for one-shot cross-sectional investigations – they are based on assessments at a given point in time, and even if they target context-general variables (such as general emotional and

motivational traits), they are administered in a specific context. However, if we want to examine the causal influence of situation (or situatedness), then we need to use designs that consider variation in time, context, or both.

Using the above  $2 \times 2$  classification of situational variation, it is possible to classify variation-focused study designs along the same two dimensions of time and context. Longitudinal studies include, by definition, change of time but often do not include much variation of context. For example, in the Project for the Analysis of Learning and Achievement in Mathematics (PALMA), we examined students' emotional development in one specific context, namely, math education (e.g., Pekrun et al., 2017). The project investigated the development of student's math emotions and motivation, including individual and social origins of this development, over the school years. However, the study used samples from one country (Germany) and considered one academic domain (mathematics), thus providing limited options to examine development across contexts.

Conversely, cross-sectional studies that include various contexts consider variation across contexts but not time. Most cross-cultural studies fall into this category. Prime examples are cross-country large-scale student assessments such as the OECD Programme for International Student Assessment (PISA). These assessments provide rich opportunities to examine the embeddedness of students' motivation and emotion in socio-cultural contexts (e.g., Guo et al., 2022). However, they are not well suited to examine development over time, even if including different age cohorts. Therefore, they are also not well suited to examine the causal processes that generate motivation, emotion, and their links with outcomes.

To overcome these limitations, it is important to use designs that simultaneously consider variation across time and context. Two types of studies can provide such as design: Experimental studies and longitudinal cross-context investigations. Experiments examine change in dependent variables over time as a function of context (i.e., different experimental

conditions). However, to reap the possible benefits of experimental designs for studying the role of situation, ecological validity needs to be considered. For example, in most experimental studies on emotion and memory, emotions were induced using task-extrinsic stimuli, such as autobiographical recall of life events. It remains open to question whether the findings hold true for students' emotions in real-life educational settings. Experimental research is needed that directly investigates the impact of task-related emotions and motivation, using ecologically representative materials.

Experimental studies are suited to examine effects of a limited number of independent variables. They are less suited to consider causal effects of broader sets of variables or to investigate reciprocal processes (see also Diener et al., 2022). Causal longitudinal studies are needed to overcome these limitations. To examine the influence of the situation, it would be especially fruitful to use longitudinal designs that consider a broader range of contexts. For example, if cross-country student assessments such as PISA would use longitudinal designs, then it would be possible to examine the development of student motivation and emotion as a function of both time and context. Such a design would make it possible to not only examine predictive or causal effects (provided that confounders are controlled), but also their generalizability across contexts – a critical requirement to derive recommendations for practice that can be used in more than one single country.

### **3.2 Dynamic Assessment Using Multiple Channels**

To assess variation over time in terms of dynamic in-the-moment processes, methods are needed that provide sufficient temporal granularity. ESM assessments as used in the contributions to this special issue are an important step in this direction. As compared with questionnaire-based self-report, ESM is better suited to assess motivational and emotional states. Nevertheless, ESM shares several problems with other self-report methods.

First, ESM is limited to assess states that are consciously accessible. Affective processes that are not noticed by the participant, either because they are generally not accessible or because the participant does not pay attention, cannot be reported. For example, this is true for the activation of brain areas, peripheral physiological arousal below the threshold of conscious awareness, and emotional contents that cannot be retrieved due to suppression. Second, although ESM aims to assess motivation and emotion as they occur in a specific moment, the assessment itself is retrospective – when ticking a box on the response scale, the affective state that is represented by the response has already been processed. Even if this process takes only a few seconds, retrieval in working memory is involved, thus making the response subject to recall biases. Third, ESM may be biased by the same response sets as other types of self-report, such as social desirability. Fourth, ESM can trigger regulatory processes that change the state before it is reported – the measurement can change its object. When the beeper signals that emotion is to be reported, then this signal alone can motivate a participant to down-regulate anxiety by re-appraising the situation. Finally, ESM is well suited to assess the dynamics of motivation and emotion over hours, days, or weeks. However, given the time it takes, it is not suited to examine the second-to-second dynamics of affective processes.

As such, ESM needs to be complemented by alternative methods, such as neuroimaging, analysis of peripheral physiological arousal, observation of facial, postural, and vocal expression, or observation of instrumental behavior (e.g., using eye tracking). However, it is important to consider that these methods have their own limitations. For example, some of the methods show high sensitivity to affective processes, but low specificity – from EDA responses, we often do not know if they represent mental effort, affective arousal, or other sources of influence.

To counterbalance advantages and limitations, it may be best to combine information from different channels. Aligning information from different channels is a challenge. Summarizing information over time such that the time intervals match across channels is a classic way out of the dilemma, but risks losing the very temporal granularity that real-time measures were designed to assess in the first place. We need to develop suitable paradigms to integrate information from different sources (see, e.g., Azevedo, 2022).

### **3.3 Within- and Between-Person Research**

Theories of motivation and emotion typically consider them as within-person processes. Nevertheless, studies of emotion and motivation in education have traditionally used between-person analysis, such as interindividual correlation and regression analysis. As argued by Dirk and Nett (2022), this is a problem - from between-person findings, we cannot infer how variables are related within persons. Statistically, between- and within-person relations can diverge widely, except if conditions hold that are rarely met (ergodicity; Voelkle et al., 2014). In empirical data as well, between- and within-person relations can differ dramatically (see Hamaker et al., 2015; Orth et al., 2021).

This is true not only for non-experimental studies but also for experiments. Between-subject experiments can generate evidence that a causal effect occurred, based on mean differences between experimental conditions. However, mean differences can mask differences of effects across persons. For example, between-person studies found that experimentally induced anxiety leads to reduced performance on difficult cognitive tasks (Zeidner, 1998). Does this mean that anxiety reduces everybody's performance on difficult tasks? Obviously, this inference may not be justified – it can well be that anxiety decreases performance in most people, but increases performance in others.

As such, within-person research is needed to test the propositions of current motivation and emotion theories. Both quantitative and qualitative methods can be suited (see



also Nolen, 2020). In experimental research, we can use within-person designs to examine causal effects. Similarly, for non-experimental studies, within-person designs can be used. Such designs can target within-person variation across time, contexts, or both. Within-person analysis based on intensive longitudinal ESM studies, as represented in the contributions to this special issue, typically focusses on variation over time. Within-person variation across contexts is analyzed, for example, in studies that examine within-person differences across different academic domains (see Murayama et al., 2017).

Various approaches to analyze the resulting data have been proposed, such as Hamaker et al.'s (2015) random-intercept cross-lagged panel model (RI-CLPM) and dynamic structural equation modeling (DSEM; Hamaker et al., 2018; Neubauer et al., 2022). Two critical challenges are the following. First, how can we design these models such that causal inferences are possible? This question is not settled, as can be seen from the current heated debate about cross-lagged models. For example, whereas some authors contend that the CLPM is not suited to infer causal conclusions because it confounds between- and within-person variation, others argue that it allows to infer causality under suitable conditions (see Lüdtke & Robitzsch, in press). For applied researchers in education, this is an unfortunate situation; they may be lost when needing to decide about which model to use for answering their substantive research questions.

Second, some of the proposed models use a fixed-effects approach that defines effects to be same for all persons (e.g., the RI-CLPM). Other models consider random effects, thus making it possible to explore the variation of effects across persons (e.g., DSEM). Using a fixed-effects model can be justified statistically when the model shows a good fit to the data. Furthermore, fixed-effects models make it possible to conduct within-person analysis with few waves of data, whereas random-effects modeling typically requires more measurement

occasions (Schultzberg & Muthén, 2018). Nevertheless, to reach valid conclusions about generalizability, it is imperative to consider possible differences of effects across persons.

The results could represent a major challenge for nomothetic theories of motivation and emotions. One possible outcome is that the relations between variables are equivalent across persons, thus making it possible to keep nomothetic propositions. To define equivalence, it may be sufficient to consider the direction and functional shape of the relation (e.g., positively linear) rather than additionally requiring that the strength of the relation is the same. The observed strength of relations can depend on various factors (e.g., person-specific reliability of measures) that are not relevant from a theory perspective. However, another possible outcome is that the relations are not equivalent. The extreme case would be that motivation and emotion function differently in each and every individual – no generalizable conclusions could be reached, and it would no longer be possible to pursue the agenda of a nomothetic science of motivation and emotion.

To examine equivalence across persons, distributions of random (i.e., person-specific) effects need to be inspected. In current publications using DSEM, typically the random effects (i.e., the variance of effects across persons) are reported, but a more complete analysis of the distribution of these effects is not performed. The central question to judge equivalence is: Does the distribution include zero effects (i.e., the relation between the variables is observed in some but not all persons), or does it include effects with opposite signs (i.e., opposite relations are observed in different persons)?

For the within-/between-persons divide, there is growing evidence that there is more equivalence than would be anticipated on statistical grounds alone. As noted earlier, several of the studies reported in this special issue document equivalence across the two levels. In our own research, Goetz et al. (2016) observed that within- and between-person relations between students' achievement goals and emotions were largely equivalent across the two levels.

Similarly, Pekrun et al. (2017; in press) found that within- and between-person effects linking students' emotions and achievement in mathematics were largely equivalent, at least in terms of the direction of effects (i.e., positive links between positive emotions and achievement, and negative links between negative emotions and achievement, at both levels).

It seems plausible that within- and between-person relations are equivalent as long as there are no external processes that disturb the equivalence. For example, within-person relations of state emotions may create equivalent between-person relations of trait emotions over time; a bottom-up process (Moeller et al., 2022). Conversely, trait emotions and trait-like ability may facilitate the generation of equivalent levels of state emotions and current achievement, a top-down process that also leads to equivalence of between- and within-person covariation.

Theoretical work as well as empirical studies are needed to further clarify equivalence across levels and persons. Under what conditions can we expect within-person and between-person relations to be the same, when do the relations diverge, and how can we theoretically explain any divergence? Similarly, under what conditions can we expect functional homogeneity of relations across persons, when can we expect heterogeneity, and how could we explain heterogeneity?

#### **4. Expanding Perspectives**

##### **4.1 Dynamic Modeling of Functional Relations**

As noted earlier, we need to better integrate existing theories on motivational and emotional processes. However, to capture the complex dynamic of these processes across time and contexts, we also need to expand existing theories. Two especially important developments are the following. First, we need more precise theories of functional relations between emotion, motivation, and other variables. Formalized theories may be best suited. In most existing motivation and emotion theories containing formal elements, these relations are

conceptualized as simple algebraic combinations, sometimes including multiplicative terms combining expectancies and values (e.g., Heckhausen, 1991; Pekrun, 2006). More complex nonlinear relations, such as exponential or power functions, are rarely considered, with few exceptions (e.g., Atkinson & Birch, 1970). Developing more precise formal models that explain the generation of motivation and emotion, possibly based on computational modeling, is an important avenue for future research in the field (see Dubey & Griffiths, 2020, for an example). To make it possible to test such models, it will also be important to further develop measures of the real-time dynamics of emotion and motivation. Lack of suitable measures may be one reason why Atkinson and Birch's (1970) pioneering work did not find the more widespread reception it would have deserved.

Second, transcending micro-theories of single functional relations, we need macro-theories modeling the interplay between larger numbers of variables, including reciprocal effects and emergent processes as argued by Moeller et al. (2022; see also Hilpert & Marchand, 2018). Important steps in this direction are the existing reciprocal effects models (REMs) of motivation and emotion, such as Marsh's REM of academic self-concept and achievement (e.g., Marsh et al., 2018) or the REMs of anxiety, boredom, and other emotions that I have developed (e.g., Pekrun, 1992; Pekrun et al., 2017). We need to include regulatory processes in these models, such as students' emotion regulation changing their anxiety over time, and to consider the emergent processes addressed by Moeller et al. (2022), such as the emergence of new emotional episodes based on combinations of emotional component processes triggered in the classroom. To more fully garner the benefits of these possible developments, it may be fruitful to combine formal micro-theories of single links into molar systems-theoretical models. Methods need to be developed for testing such models, similar to the development of methods for testing complex models in other fields (e.g., research on climate change).

## 2.2 Target Constructs and Populations

Research in the field has focused on the achievement domain. The contributions to this special issue are an example; all of them foreground achievement-related constructs. For future research, it is an important avenue to more fully consider the broad range of motivations and emotions that play a role in education. For example, beyond achievement emotions, educational research should consider epistemic emotions and social emotions. Epistemic emotions like surprise, curiosity, and confusion relate to the knowledge-generating qualities of task materials. These emotions can be prime drivers of learning and problem solving. Research on these emotions is a nascent field that needs to be further developed (see Muis et al., 2018; Vogl et al., 2020). Social emotions relate to other persons, such as love, admiration, compassion, hate, contempt, and envy. These emotions are critically important for teacher-student interaction and students' learning in peer groups. We need more knowledge, for example, about the role of social emotions in creating friendships in class, or in episodes of bullying and victimization and their dire consequences for both victims and bullies.

In addition, it is important to consider how students regulate their emotions and motivation. Regulation of affective processes is a core component of students' self-regulation of learning. Nevertheless, progress of research on emotion and motivation regulation has been slow to emerge, in part because suitable measurement instruments targeting multiple regulatory strategies are still largely lacking.

In most existing studies on motivation and emotion in education, students have been the focus (e.g., in all contributions to this special issue, the participant samples consisted of students). Relative to the volume of research on students, teachers' and parents' motivation and emotion have been neglected. This is unfortunate because teachers and parents have an overarching influence on students, and because motivation and emotion are crucial for their own well-being, health, and development. In addition, the emotions and motivation of other

stakeholders, including educational administrators and policy-makers, should receive more attention.

For example, even if they do not teach themselves, school principals have a major influence on students. The effects for each individual student may be relatively small. These effects are indirect; they are mediated by the single teachers supervised by the principal. However, because principals have an influence on teachers and procedures in the whole school, their overall influence can be substantial. Similarly, educational policymakers are critical as they can influence the structures and functions of whole educational systems.

#### **4.3 Relative Universality: Socio-Cultural and Historical Contexts**

The objects, cognitive contents, frequency, and intensity of emotion and motivation can vary widely across persons, genders, academic domains, and socio-cultural contexts. As noted earlier, a critical question is whether this is also true for the functional relations of motivation and emotion with their origins and outcomes. For example, emotions such as students' math anxiety are known to differ between genders and cultures (Pekrun, 2018). Do the relations of math anxiety with students' achievement in mathematics differ as well? Taking a nomothetic perspective, theories such as control-value theory propose that the functional relations are universal in our species, with possible exceptions such as young infants or persons who suffer from disorders that affect the central nervous system.

For examining the "relative universality" (Pekrun, 2006, 2018) of motivation and emotion, studies are needed that consider variation across contexts, thus making it possible to examine generalizability. Traditionally, meta-analysis was considered a prime method to investigate generalizability. However, meta-analysis shares the advantages and limitations of the primary studies considered. Studies of motivation and emotion in education used different designs, were situated in different academic domains, and employed different measures, thus allowing to examine generalizability across these sources of variation. However, most of the

extant studies were situated in WEIRD (Western, Educated, Industrialized, Rich, Democratic) countries and used samples from these countries. As such, the potential of meta-analysis to examine generalizability across cultural contexts is limited.

From this perspective, a promising alternative is to use data from international student, teacher or parent assessments that include samples from a broader range of countries (see, e.g., Marsh et al., in press). We need theory-guided original studies that target variation across contexts, but we should also make more use of options to conduct secondary data analyses of the existing cross-country datasets that are available today.

In addition, it is important to note that education not only varies across cultural contexts but also over historical epochs. It seems likely, but has barely investigated empirically, that motivation and emotion vary over decades and centuries. For example, the change of educational institutions and practices over time suggests that students' anxieties change as well. The authoritarian styles of teaching and parenting in 19<sup>th</sup> century pedagogy may have promoted fear of teachers and parents and the corporal punishments following lack of discipline. In contrast, today's high-stakes exams foreground the importance of achievement, thus triggering fear of failure, and fear of the loss of affection from others that can result from failure. Comparative evidence on these possible historical changes is largely lacking. Interdisciplinary collaboration with historians is needed to gather such evidence.

Evidence on universality across socio-cultural and historical contexts is especially important to judge the applicability of treatment interventions, and the generalizability of recommendations for educational practice, across cultures and times. To what extent are current motivation and emotion interventions usable across countries, and across contexts within countries? Targeted multi-country and multi-contexts intervention research is needed to answer this question. Similarly, research on change of classroom practices that broadens

the perspective beyond single countries is needed to establish broad applicability of current recommendations (e.g., Linnenbrink et al., 2016).

## **5. Conclusion**

Research on situated motivation and emotion in education has made tremendous progress over the past few years, as documented in the contributions to this special issue. However, the field is still in a nascent stage. For example, as compared with several thousands of existing between-person studies on constructs such as self-concept, test anxiety, or achievement goals, to date there still are no more than a handful of within-person investigations targeting the same constructs. More within-person research is needed to reach firm conclusions about the role of time and context, and to inform practitioners and policy-makers in evidence-based ways. Important steps include integrating and expanding existing theories, considering variation across both time and contexts, investigating motivation and emotion beyond the achievement domain, and including samples and contexts beyond WEIRD countries.



### References

- Atkinson, J. W., & Birch, D. (1970). *The dynamics of action*. Wiley.
- Azevedo, R., Bouchet, F., Duffy, M., Harley, J., Taub, M., Trevors, G., Cloude, E., Dever, D., Wiedbusch, M., Wortha, F., & Cerezo, R. (2022). Lessons learned and future directions of MetaTutor: Leveraging multichannel data to scaffold self-regulated learning with an intelligent tutoring system. *Frontiers in Psychology, Section Educational Psychology*, 14 June 2022. <https://doi.org/10.3389/fpsyg.2022.813632>
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, 84(2), 191–215. <https://doi.org/10.1037/0033-295X.84.2.191>
- Bieg, S., Dresel, M., Goetz, T., Nett, U. (2022). Teachers' enthusiasm and humor and its' lagged relationships with students' enjoyment and boredom - A latent trait-state-approach. *Learning and Instruction*. Advance online publication. <doi>
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press.
- Diener, E., Northcott, R., Zyphur, M. J., & West, S., G. (2022). Beyond experiments. *Perspectives on Psychological Science*, 17(4), 1101–1119. <https://doi.org/10.1177/17456916211037670>
- Dirk, J., & Nett, U. E. (2022). Postscript: Uncovering the situational impact in educational settings: Studies on motivational and emotional experiences. *Learning and Instruction*. Advance online publication. <doi>
- Dubey, R., & Griffiths, T. L. (2020). Reconciling novelty and complexity through a rational analysis of curiosity. *Psychological Review*, 127(3), 455–476. <https://doi.org/10.1037/rev0000175>
- Eccles, J. S., & Wigfield, A. (2020). From expectancy-value theory to situated expectancy-value theory: A developmental, social cognitive, and sociocultural perspective on

- motivation. *Contemporary Educational Psychology*, 61, April 2020, 101859.  
<https://doi.org/10.1016/j.cedpsych.2020.101859>
- Elliot, A. J., Dweck, C. S., & Yeager, D. S. (Eds.). (2017). *Handbook of competence and motivation (2nd edition): Theory and application*. Guilford.
- Goetz, T., Frenzel, A. C., Stoeger, H., Hall, N. C. (2010). Antecedents of everyday positive emotions: An experience sampling analysis. *Motivation and Emotion*, 34(1), 49-62.  
<https://doi.org/10.1007/s11031-009-9152-2>
- Goetz, T., Sticca, F., Pekrun, R., Murayama, K., & Elliot, A. J. (2016). Intraindividual relations between achievement goals and discrete achievement emotions: An experience sampling approach. *Learning and Instruction*, 41, 115–125.  
<https://doi.org/10.1016/j.learninstruc.2015.10.007>
- Guo, J., Hu, X., Marsh, H. W., & Pekrun, R. (2022). Relations of epistemic beliefs with motivation, achievement, and aspirations in science: Generalizability across 72 societies. *Journal of Educational Psychology*, 114(4), 734–751.  
<https://doi.org/10.1037/edu0000660>
- Hamaker, E. L., Asparouhov, T., Brose, A., Schmiedek, F., & Muthén, B. (2018). At the frontiers of modeling intensive longitudinal data: dynamic structural equation models for the affective measurements from the COGITO study. *Multivariate Behavioral Research*, 53(6), 820–841. <https://doi.org/10.1080/00273171.2018.1446819>
- Hamaker, E. L., Kuiper, R. M., & Grasman, R. P. P. P. (2015). A critique of the cross-lagged panel model. *Psychological Methods*, 20(1), 102–116.  
<https://doi.org/10.1037/a0038889>
- Heckhausen, H. (1991). *Motivation and action*. Springer.

- Hilpert, J. C., & Marchand, G. C. (2018). Complex systems research in educational psychology: Aligning theory and method. *Educational Psychologist, 53*(3), 185–202. <https://doi.org/10.1080/00461520.2018.1469411>
- Krannich, M., Götz, T., Roos, A.-L., Murayama, K., Keller, M., Bieg, M., & Lipnevich, A. A. (2022). Predictive validity of state versus trait challenge and boredom for career aspirations. *Learning and Instruction*. Advance online publication. <https://doi.org/10.1016/j.learninstruc.2022.101596>
- Lewin, K. (1935). *A dynamic theory of personality*. McGraw-Hill.
- Linnenbrink-Garcia, L., Patall, E. A., & Pekrun, R. (2016). Adaptive motivation and emotion in education: Research and principles for instructional design. *Policy Insights from the Behavioral and Brain Sciences, 3*(2), 228–236. <https://doi.org/10.1177/2372732216644450>
- Lüdtke, O., & Robitzsch, A. (in press). A comparison of different approaches for estimating cross-lagged effects from a causal inference perspective. *Structural Equation Modeling*.
- Marsh, H. W., Pekrun, R., Murayama, K., Arens, A. K., Parker, P. D., Guo, J., & Dicke, T. (2018). An integrated model of academic self-concept development: Academic self-concept, grades, test scores, and tracking over six years. *Developmental Psychology, 54*(2), 263–280. <https://doi.org/10.1037/dev0000393>
- Marsh, H. W., Pekrun, R., Parker, P. D., Murayama, K., Guo, J., Dicke, T., & Arens, A. K. (2019). The murky distinction between self-concept and self-efficacy: Beware of lurking jingle-jangle fallacies. *Journal of Educational Psychology, 111*(2), 331–353. <https://doi.org/10.1037/edu0000281>
- Marsh, H. W., Reeve, J., Guo, J., Pekrun, R., Parada, R. H., Parker, P. D., Basarkod, G., Craven, R., Jang, H.-R., Dicke, T., Ciarrochi, J., Sahdra, B., Devine, E. K., Cheon, S. H. (in

- press). Overcoming limitations in peer victimization research that impede successful intervention. *Perspectives on Psychological Science*.
- Moeller, J., Viljaranta, J., Tolvanen, A. J., Kracke, B., & Dietrich, J. (2022). Introducing the DYNAMICS Framework of moment-to-moment development in achievement motivation. *Learning and Instruction*. Advance online publication. <doi>
- Muis, K. R., Chevrier, M., Singh, C. A. (2018). The Role of Epistemic Emotions in Personal Epistemology and Self-Regulated Learning. *Educational Psychologist*, 53(3), 165-184. <https://doi.org/10.1080/00461520.2017.1421465>.
- Murayama, K., Goetz, T., Malmberg, L.-E., Pekrun, R., Tanaka, A., & Martin, A. J. (2017). Within-person analysis in educational psychology: Importance and illustrations. In D. W. Putwain & K. Smart (Eds.), *British Journal of Educational Psychology Monograph Series II: Psychological Aspects of Education – Current Trends: The Role of Competence Beliefs in Teaching and Learning* (pp. 71–87). Wiley.
- Nagengast, B., Marsh, H. W., Scalas, L. F., Xu, M. K., Hau, K.-T., & Trautwein, U. (2011). Who took the “×” out of expectancy-value theory?: A psychological mystery, a substantive-methodological synergy, and a cross-national generalization. *Psychological Science*, 22(8), 1058-1066. <https://doi.org/10.1177/0956797611415540>
- Neubauer, A. B., Schmidt, A., Schmiedek, F., & Dirk, J. (2022). Dynamic reciprocal relations of achievement goals with daily experiences of academic success and failure: An ambulatory assessment study. *Learning and Instruction*. Advance online publication. <https://doi.org/10.1016/j.learninstruc.2022.101617>
- Nolen, S., (2020). A situative turn in the conversation on motivation theories. *Contemporary Educational Psychology*, 61, 101866. <https://doi.org/10.1016/j.cedpsych.2020.101866>

- Pekrun, R. (1988). *Emotion, Motivation und Persönlichkeit* [Emotion, motivation, and personality]. Psychologie Verlags Union.
- Pekrun, R. (1992). The expectancy-value theory of anxiety: Overview and implications. In D.G. Forgays, T. Sosnowski, & K. Wrzesniewski (Eds.), *Anxiety: Recent developments in self-appraisal, psychophysiological and health research* (pp. 23–41). Hemisphere.
- Pekrun, R. (1993). Facets of students' academic motivation: A longitudinal expectancy-value approach. In M. Maehr & P. Pintrich (Eds.), *Advances in motivation and achievement* (Vol. 8, pp. 139–189). JAI Press.
- Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review, 18*(4), 315–341. <https://doi.org/10.1007/s10648-006-9029-9>
- Pekrun, R. (2018). Control-value theory: A social-cognitive approach to achievement emotions. In G. A. D. Liem & D. M. McInerney (Eds.), *Big theories revisited 2: A volume of research on sociocultural influences on motivation and learning* (pp. 162–190). Information Age Publishing.
- Pekrun, R. (2019). The murky distinction between curiosity and interest: State of the art and future directions. *Educational Psychology Review, 31*(4), 905–914. <https://doi.org/10.1007/s10648-019-09512-1>
- Pekrun, R. (2021). Self-appraisals and emotions: A generalized control-value approach. In T. Dicke, F. Guay, H. W. Marsh, R. G. Craven, & D. M. McInerney (Eds.). *Self – a multidisciplinary concept* (pp. 1–30). Information Age Publishing.
- Pekrun, R. (in press a). Jingle-jangle fallacies in motivation science: Towards a definition of core motivation. In M. Bong, S. Kim, & J. Reeve (Eds.), *Motivation science: Controversies and insights*. Oxford University Press.

- Pekrun, R. (in press b). Dissecting the elephant: Cognition, emotion, and motivation as distinct but intertwined entities. In M. Bong, S. Kim, & J. Reeve (Eds.), *Motivation science: Controversies and insights*. Oxford University Press.
- Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology, 36*(1), 36–48.  
<https://doi.org/10.1016/j.cedpsych.2010.10.002>
- Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: Longitudinal models of reciprocal effects. *Child Development, 88*(5), 1653–1670. <https://doi.org/10.1111/cdev.12704>
- Pekrun, R., & Linnenbink-Garcia, L. (in press). Academic emotions and student engagement. In A. L. Reschly & S. L. Christenson (Eds.), *The handbook of research on student engagement* (2<sup>nd</sup> edition). Springer.
- Pekrun, R., Marsh, H. W., Suessenbach, F., Frenzel, A. C., & Goetz, T. (in press). School grades and students' emotions: Longitudinal models of within-person reciprocal effects. *Learning and Instruction*.
- Pinder, C. C. (Ed.). (2008). *Work motivation in organizational behavior*. Psychology Press.  
<https://doi.org/10.4324/9781315734606>
- Raynor, J. O., & Roeder, G. P. (1987). Motivation and future orientation: Task and time effects for achievement motivation. In F. Halisch & J. Kuhl (Eds.) *Motivation, intention, and volition*. Springer. [https://doi.org/10.1007/978-3-642-70967-8\\_6](https://doi.org/10.1007/978-3-642-70967-8_6)
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. The Guilford Press.

- Scherer, K. R., & Moors, A., (2019). The emotion process: Event appraisal and component differentiation. *Annual Review of Psychology*, 7, 719–745.  
<https://doi.org/10.1146/annurev-psych-122216-011854>
- Schultzberg, M., & Muthén, B. (2018). Number of subjects and time points needed for multilevel time-series analysis: A simulation study of dynamic structural equation modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 25(4), 495–515. <https://doi.org/10.1080/10705511.2017.1392862>
- Shao, K., Pekrun, R., Marsh, H. W., & Loderer, K. (2020). Control-value appraisals, achievement emotions, and foreign language performance: A latent interaction analysis. *Learning and Instruction*, 69, Article 101356.  
<https://doi.org/10.1016/j.learninstruc.2020.101356>
- Skinner, E. A. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology*, 71(3), 549–570. <https://doi.org/10.1037/0022-3514.71.3.549>
- Tamura, A., Ishii, R., Yagi, A., Fukuzumi, N., Hatano, A., Sakaki, M., Tanaka, A., & Murayama, K. (2022). Exploring the within-person contemporaneous network of motivational engagement. *Learning and Instruction*. Advance online publication.  
<doi>
- Talic, I., Scherer, R., Marsh, H. W., Greiff, S., Möller, J., & Niepel, C. (2022). Uncovering everyday dynamics in students' perceptions of instructional quality with experience sampling. *Learning and Instruction*. Advance online publication.  
<https://doi.org/10.1016/j.learninstruc.2022.101594>
- Voelkle, M. C., Brose, A., Schmiedek, F., & Lindenberger, U. (2014). Toward a unified framework for the study of between-person and within-person structures: Building a bridge between two research paradigms. *Multivariate Behavioral Research*, 49(3), 193–213. <https://doi.org/10.1080/00273171.2014.889593>

Vogl, E., Pekrun, R., Murayama, K., & Loderer, K. (2020). Surprised – curious – confused:

Epistemic emotions and knowledge exploration. *Emotion, 20*(4), 625–641.

<https://doi.org/10.1037/emo0000578>

Weiner, B. (1985). An attributional theory of achievement motivation and emotion.

*Psychological Review, 92*(4), 548–573.

Wieland, L. M., Hoppe, J. D., Wolgast, A., & Ebner-Priemer, U. W. (2022). Task ambiguity

and academic procrastination: An experience sampling approach. *Learning and*

*Instruction*. Advance online publication.

<https://doi.org/10.1016/j.learninstruc.2022.101595>

Wigfield, A., & Eccles, J. S. (2000). Expectancy–value theory of achievement motivation.

*Contemporary Educational Psychology, 25*(1), 68-81.

<https://doi.org/10.1006/ceps.1999.1015>

Wittgenstein, L. (1953). *Philosophical investigations*. Macmillan Publishing.

Zeidner, M. (1998). *Test anxiety: The state of the art*. Plenum.



**Table 1***A 2 × 2 Model of Situational Variation and Study Designs*

	<i>Contexts</i>	
<i>Time points</i>	No variation	Variation
No variation	Time-invariant, context-invariant (cross-sectional single-context studies)	Time-invariant, context-variable (cross-sectional comparative studies)
Variation	Time-variable, context-invariant (longitudinal single-context studies)	Time-variable, context-variable (longitudinal comparative studies)