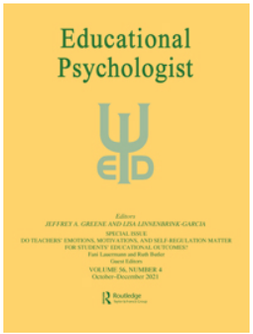

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Reinhard Pekrun

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COMMENTARY

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Teachers need more than knowledge: Why motivation, emotion, and self-regulation are indispensable

Reinhard Pekrun[a,b,c]

[a]Department of Psychology, University of Essex, Colchester, UK; [b]Institute for Positive Psychology and Education, Australian Catholic University, Sydney, Australia; [c]Department of Psychology, University of Munich, Munich, Germany

ABSTRACT

It is plausible to assume that teachers need motivation, emotions, and self-regulation to teach and promote students' learning. However, as documented in this special issue, extant research is inconsistent and has documented weak effects of these teacher variables at best. I discuss possible reasons for this paradoxical failure to more fully document the importance of motivation, emotion, and self-regulation. Specifically, in addition to conceptual problems, research has focused too much on using between-person designs, variables with truncated distributions and reduced variance, and samples from single Western countries. To better understand the effects of teacher variables on student outcomes, we need to (1) develop and test more fine-grained theoretical models explaining the mechanisms mediating these effects, (2) complement between-teacher research by within-teacher studies, and (3) examine teacher-student processes across cultural and historical contexts. Collaboration with other disciplines may be needed, including economics, sociology, political science, computer science, and history.

It is intuitively plausible and theoretically compelling to assume that teachers' motivation, emotion, and self-regulation influence their students' development. Nevertheless, as aptly documented in the contributions to this special issue, related evidence is inconsistent, and effect sizes—if there are any associations—are typically weak. This begs the question: Is there sufficient "space" (Bardach & Klassen, 2021/this issue, p. 289) for teacher motivation, emotion, and self-regulation to matter for student outcomes? If yes, then a number of further questions follow. Three of them may be especially important: How are these teacher effects generated; should we conceptualize them as between- or within-teacher effects; and are they generalizable across contexts? Based on theory and the available evidence summarized in the four articles, I will provide preliminary answers to these questions and outline directions for future research. Before doing so, I address the three concepts involved: Motivation, emotion, and self-regulation.

Concepts of motivation, emotion, and self-regulation

Similar to other psychological concepts, terms denoting constructs of motivation, emotion, and self-regulation are used in a myriad of different ways. This is unfortunate because divergent use of words can lead to misunderstandings and confusion. Moreover, different definitions prompt researchers to develop diverging measures of the three constructs, which makes it difficult to compare and integrate findings across studies and derive evidence-based recommendations for practice (see, e.g., Lauermann & ten Hagen, 2021/this issue, for the current confusion about terms for teachers' competence beliefs and self-efficacy).

Defining the three concepts

Among the three concepts, *motivation* may be the least clear. Traditionally, the term was used to denote any psychological processes that shape goal direction, intensity, and persistence of behavior. From this perspective, emotions and self-regulation would be considered as part of motivation, given that they contribute to defining these three parameters of behavior. In addition, all types of cognitions that influence the three parameters, either directly or through effects on emotion and self-regulation, should also be considered motivation. Examples are expectancies, perceptions of control, and value beliefs that shape individuals' motivation, emotions, and behavioral decisions (Eccles & Wigfield, 2020; Lauermann & ten Hagen, 2021/this issue; Pekrun, 2006, in press-b). However, such a definition may be considered overly broad and not sufficiently specific to guide educational research and practice. For example, using this definition, teachers' emotions would not be differentiated from their motivation but be just one part of it.

CONTACT Reinhard Pekrun pekrun@lmu.de Department of Psychology, University of Essex, Wivenhoe Park, Colchester CO4 3SQ, UK.

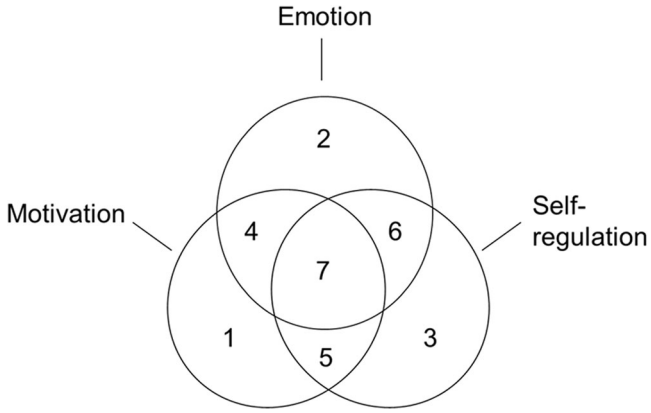

Figure 1. Teacher motivation, emotion, and self-regulation: Venn diagram of conceptual overlap. The size of the seven sub-areas serves visibility but does not represent frequency of occurrence. Area #7 (representing motivation and emotion as components of self-regulation) may be the most typical case.

To provide a more specific definition of motivation, I have proposed the concept of *core motivation* which denotes processes that are the most proximal psychological antecedents of goal direction, intensity, and persistence, namely mental representations of desired states and actions (Pekrun, in press-b). Prime members of this category are goals, wishes, and intentions related to performing actions and attaining desired states, such as a teacher's goals and intentions to successfully teach a math class and foster students' understanding (see also Butler, 2007; Butler & Shibaz, 2008). From this perspective, more distal antecedents of action, such as teachers' competence beliefs, exert their influence through shaping core motivation—the effects of beliefs on teaching are mediated by teachers' intentions and decisions to teach.

As aptly summarized by Frenzel et al. (2021/this issue), *emotions* are commonly seen as systems of synchronized processes in response to subjectively important events. In the prototypical case, these processes include affective, cognitive, physiological, motivational, and behavioral-expressive components. For example, a teacher's fear of teaching may comprise anxious feelings when preparing a lesson, worries about not being able to manage the class, increased heartbeat, motivation to avoid teaching if possible, and anxious facial expressions. This conception of emotion implies that motivation can be part of emotion.

Finally, although there is disagreement about the phases and components involved, self-regulation can be broadly defined as processes of self-directed planning, controlling, and evaluating behavior (Baumeister & Vohs, 2007; Kanfer & Hagerman, 1981). In educational research, a classic example is Zimmerman's model of self-regulated learning, which considers forethought, performance, and self-reflection as separable phases of learning (see Zimmerman, 2000, 2013; review in Panadero, 2017). As shown by Kramarski and Heaysman (2021/this issue), the model can be similarly used to describe teachers' self-regulation. These authors outline that it is useful to distinguish teachers' own self-regulation from teaching students how to self-regulate learning, which makes it possible to conceptualize three types of self-regulation: Teachers' self-regulation of their own learning, their self-regulation of teaching, and their teaching of self-regulation. Especially the first two types of self-regulation may often coincide: A major part of teachers' learning how to teach consists of practicing teaching, implying that self-regulation of learning and teaching can be one and the same process.

Conceptual overlap: Implications for research and intervention

From these definitions, it follows that motivation, emotion, and self-regulation are overlapping concepts (Figure 1; in addition, all three also show overlap with cognition; Pekrun, in press-a). As part of an emotional response, *motivation* is a component process of emotion; however, alternatively, motivation can comprise other kinds of desires (area #1 in Figure 1). For example, the desire to eat can be driven by feelings of hunger, and the desire to teach can result from professional goals to promote students' growth rather than any specific emotion. Conversely, *emotions* can include motivational components, but this is not always the case. For example, positive emotions like enjoying a beautiful sunny morning need not trigger any specific motivational impulses (area #2).

Similarly, both emotion and motivation overlap with *self-regulation*. Emotions and motivation are crucial components of self-regulation throughout all phases of planning, performing, and evaluating actions. Emotions have often been overlooked in models of self-regulation, but are as crucial as motivation, goal setting, and metacognition (Schiefele & Pekrun, 1996). Looking forward to seeing one's students in class the next day promotes the goal to be on time; enjoying teaching the class supports adapting instruction in flexible ways; and subsequent pride about one's accomplishments can fuel intentions to carefully plan the next lesson. Alternatively, less deliberate types of self-regulation can come without any specific goals or intentions, and without any specific emotions (area #3). Conversely, emotions can be prompted by any events at school, beyond behavioral self-regulation, and motivation can lead to immediate, spontaneous behavior rather than self-regulated action.

Nevertheless, in the more typical case, motivation, emotions, and self-regulation are combined and difficult to disentangle (area #7). This overlap has important consequences for the assessment of these constructs and related intervention (Pekrun, in press-a). The close relations between motivation, emotion, and self-regulation make it difficult, and in some cases even impossible, to assess them in empirically distinguishable ways. The overlap between the constructs is reflected in the overlap between related measures. This is a problem for any research on the relations between variables of teacher emotion, motivation, and self-regulation—to the extent that they measure the same phenomena, empirical relations between the measures may be boosted by overlap rather than reflecting relations between separate constructs.

For example, as explained by Pekrun (in press-a), self-report measures of motivation often comprise items

reflecting emotions, and self-report measures of emotion often include questions reflecting motivation. A case in point is measures of intrinsic motivation that include items asking for enjoyment. For example, the intrinsic motivation scale of the Intrinsic Motivation Inventory (IMI; McAuley et al., 1989) developed to measure motivational constructs of self-determination theory contains items such as, "I enjoyed doing this activity very much." Items of this type imply that motivation is measured through emotion. Conversely, emotion measures such as the Achievement Emotions Questionnaire (AEQ; Pekrun et al., 2011) include items assessing the motivational component of emotions (e.g., "Certain subjects are so enjoyable that I am motivated to do extra readings about them" as an item assessing learning-related enjoyment). These items measure emotions through motivation. Furthermore, even if motivation items do not explicitly reflect emotion, and if emotion items do not explicitly mention motivation, items can be understood by responding teachers as referring to integrated motivation-emotion episodes rather than to separate processes.

The resulting construct overlap between measures presents a conundrum. To solve the problem, it would be possible (and is sometimes recommended) to leave out emotion items from motivation measures and leave out motivation items from emotion measures. However, while such a procedure may render empirical scores and relations between variables that are less affected by overlap, it also implies reducing the construct validity of the measures. Reduced measures would be less suited to capture the richness of the multiple components of teacher motivation and emotion (see also Lawson & Robins, in press).

The overlap between constructs also affects the design, procedures, and outcomes of interventions. For example, designers of motivation interventions typically aim to change motivation and do not consider effects on emotion, and designers of emotion interventions aim to modify emotion and are less concerned about motivational effects. However, given the close relation between motivation and emotion, motivation interventions inevitably also affect emotion, and emotion interventions affect motivation. For example, attributional retraining, which was conceptualized to change participants' motivation, likely also affects their emotions, thus possibly being suited to change both motivation and emotion (see Perry et al., 2014).

The dual nature of motivation and emotion interventions further implies that interventions targeting motivation might have undesired effects on emotions, and interventions targeting emotion undesired effects on motivation. For example, if a motivation intervention aims to boost teachers' perceived value of actions and outcomes, we need to consider that high value can intensify not only motivation but also resulting emotions—both positive and negative. For instance, increasing the importance of success and failure may not only strengthen teachers' achievement motivation but also their anxiety and fear of failure.

Finally, similar principles hold for interventions targeting teachers' self-regulation, given that emotion and motivation are crucial components of self-regulation. Treatments aiming to change self-regulatory skills, such as Kramarski and Heaysman's (2021/this issue) training to improve teachers' self-regulation, can at the same time exert effects on teachers' motivation and emotion. As such, we need to be aware of the overlap between the three constructs. This awareness is important when designing interventions because there may be effects in all three domains, rather than only effects in the target domain of the intervention.

Is there sufficient "space" to influence student outcomes?

As defined above, how important are teachers' motivation, emotion, and self-regulation for students' learning and well-being? In other words, do they exert a causal influence on students? Is there sufficient "space" (Bardach & Klassen, 2021/this issue) for such an influence? I will first consider this question for motivation as defined above, and then expand the view to include emotion and self-regulation.

The role of teacher motivation

The summaries provided in this special issue suggest that variables of teacher motivation exert small effects on students at best (Bardach & Klassen, 2021/this issue; Lauermann & ten Hagen, 2021/this issue). However, does this evidence represent reality? From a theory perspective, it can be argued that teachers' core motivation is a *necessary* condition for students' learning at school. From early on, production models of performance have emphasized that performing a given behavior is a joint function of ability and motivation, with both components necessary for the behavior to be performed (see, e.g., Anderson & Butzin, 1974; Kanfer & Ackerman, 1989; Vroom, 1964). This is true both for simple motor movements (with a few exceptions like stimulus-bound reflexes) and for complex social behaviors like teaching in the classroom.

If somebody is not able to ride a bike, they will not ride the bike even if highly motivated. Conversely, if the person learned how to ride a bike but lacks any motivation to do so in a given situation, then they also will not ride the bike. Similarly, if a person lacks any knowledge about calculus, then this person cannot teach calculus even if highly motivated to do so. If the person has been trained as a math teacher and is knowledgeable, but lacks any motivation to teach, then no teaching will be performed either. If motivation is completely lacking, then this person would not even care for attending school but instead pursue alternative activities. By implication, to the extent that students learn at school through teaching, teachers' motivation is a *necessary condition* for student learning to occur.

However, for unveiling the causal importance of teacher motivation in empirical studies, two requirements need to be met. As a general rule, two necessary (though not sufficient) conditions for detecting causality are (1) there is variation in the cause, and (2) there is variation in the outcome. Is there sufficient variance in teachers' motivation to detect a causal influence on students, and is there sufficient

variance in student outcomes that leaves room to discover such an influence?

Variance in teacher motivation

In modern society, educational institutions are organized such that teacher motivation is enforced through institutional rules. Teachers are not free to either attend their workplace or not, depending on their daily motivation. Teachers who do not show up due to lack of motivation lose their position. In addition, persons who are not motivated at all to teach may not enter the profession in the first place. As such, both institutional rules and self-selection typically make sure that the distribution of teacher motivation is *truncated at lower levels*. The resulting reduction of variance makes it more difficult to detect a causal influence. However, thought experiments and evidence on teacher absenteeism can help us to understand the power of teacher motivation.

In terms of a thought experiment, let us consider the counterfactual case that there are some teachers who are motivated to teach and, accordingly, teach their classes, and that there are other teachers who are not motivated and continuously stay away from their assigned classes (but nevertheless continue to be paid). As long as the institution is not able to provide substitute teachers to teach the second group of classes, students from these classes do not receive teaching, and they will not learn any content that needs to be taught by teachers.

This thought experiment is supported by evidence. Research has confirmed substantial negative effects of teacher absenteeism on student achievement. For example, in the analysis by Miller et al. (2008), it was estimated that each 10 days of teacher absences reduced students' mathematics achievement by 3.3 percent of a standard deviation. Furthermore, there is at least anecdotal evidence of historical situations, as well as schools in more recent years, where teachers did not teach their assigned classes due to lack of motivation, possibly caused by a combination of underpayment and overchallenge in facing appalling teaching conditions (such as very large classes in some townships in South Africa), with devastating consequences for students' learning (see also Pitsoe & Machaisa, 2012). In line with this evidence, providing incentives to increase teacher motivation and reduce absenteeism can be effective in boosting student achievement (Duflo et al., 2012).

In addition to quantitative parameters of motivation, the *quality* of teacher motivation should also make a critical difference for student outcomes, such as extrinsic motivation to fulfill one's duties in order to earn a salary versus intrinsic motivation to promote students' growth. As pointed out by Bardach and Klassen (2021/this issue), different motivational orientations are likely to promote different instructional strategies, thus affecting students in different ways. However, as these authors argue, variation in types of motivation, and especially the occurrence of high-quality intrinsic motivation, may be also be restricted by contextual conditions such as prescribed curricula and pressure from principals and parents. In sum, the variance of both quantitative and qualitative parameters of teacher motivation may have been restricted in empirical studies, making it difficult to recognize the power of motivation.

Variance in student outcomes

Most student outcomes, such as academic achievement, show substantial between-person variation. However, how much of this variation can be explained by teacher motivation given the influence of other factors? It could be argued that student outcomes are determined by other variables, including students' genotype and cognitive traits, to such an extent that not much space is left for teachers to have an impact. For example, Bardach and Klassen (2021/this issue, p. 289) point out that the close links between cognitive student characteristics and student outcomes leave "arguably very limited space for potential teacher effects." Especially the influence of genetic factors and the heritability of educational attainment are currently (again) topics of hot and controversial debate, both in science and in the media (see, e.g., Harden, 2021; Koellinger & Harden, 2018; Lewis-Kraus, 2021). Nevertheless, it seems clear that a substantial portion of the between-person variance of student achievement can be explained by genetic and cognitive student variables, as indicated by twin studies, research on polygenic effects, and correlations between intelligence and achievement. Despite this evidence, I propose that we should be cautious in inferring that teachers cannot make much of a difference, for the following reasons.

As for *genetic factors*, heritability coefficients are sample statistics that are defined relative to a given population. They inform us about how much of the variance in some phenotype can be explained by variance in the genotype (or by interactions and covariations of genotype and environment). However, they do not inform us about the importance of both genotype and the environment for the development of each person. Without genes that guide physical growth, children would not grow; without nutrition, they would not grow either. Both components are needed for growth to occur. Similarly, for students' learning, both genetic dispositions and environmental opportunities to learn are required. Furthermore, heritability coefficients do not inform us about the plasticity of a phenotype. Whatever the correlation between genotype and phenotype, the phenotype can change due to a change in environmental circumstances. A prime example is the increase of average levels of intelligence during the 20th century ("Flynn effect"; Bratsberg & Rogeberg, 2018; Trahan et al., 2014), which occurred despite substantial heritability. In addition to improvements in nutrition and healthcare, this increase is likely due to improved schooling and the impact of teachers.

Regarding *cognitive student variables*, intelligence typically explains a higher percentage of the variance in academic achievement than other (phenotypical) variables. However, again, truncation of empirical distributions and interactions between factors need to be considered. Specifically, similar to teacher motivation, distributions of student motivation may also be truncated—obligatory attendance at school, and the consequences of nonattendance, ensure that motivation

in most students is at least sufficient to compel them to get up in the morning and attend classes. As such, whereas basic cognitive abilities broadly vary in the student population, variance in motivation is reduced, which entails reduced power to explain between-person variance in resulting achievement. However, reduced variance notwithstanding, production laws of performance as cited earlier should hold for students' academic learning as well—both cognitive abilities and motivation are needed to successfully study academic materials. Motivation is crucial, regardless of the amount of explained variance in between-person distributions of achievement.

If we underestimate the importance of student motivation, then we may also underestimate the role of teacher motivation. Specifically, to the extent that the influence of teacher motivation on student outcomes is mediated by students' motivation, reduced variance in student motivation makes it more difficult to document the fundamentally important role of teacher motivation.

In sum, teacher motivation is indispensable to generate student outcomes, as implied by generic production rules of performance. However, institutional rules truncate distributions of teacher and student motivation, which makes it difficult to detect the importance of motivation in classic study designs that use between-person distributions to estimate teacher effects. Amending between-person research by within-person studies may be one way to deal with this dilemma (see section on between-teacher and within-teacher effects).

The role of teacher emotions and self-regulation

As argued above, core teacher motivation is indispensable for attaining any student outcomes that are mediated by teaching. For other motivational variables, emotions, and teachers' self-regulation, this is less clear. Nevertheless, for variables other than core motivation as well, considering their functional status in the generation of student outcomes may help. For example, teachers' *competence beliefs* as discussed by Lauermann and ten Hagen (2021/this issue) may or may not influence teachers' core motivation to teach. To the extent that they do influence core teaching motivation, they should exert a substantial influence; however, especially for externally driven motivation, competence beliefs may not always be crucial. As such, competence beliefs can substantially influence teaching-contingent student outcomes; however, they are not necessary requirements to perform teaching and attain student outcomes, in contrast to core motivation.

The same may be true for teachers' *emotions*. Teachers do not need to experience emotions to teach their classes; in fact, teaching can alternatively be performed by emotion-less avatars. However, given its importance in teachers' professional life, teaching can generate intense emotions, as documented in the evidence on teacher emotions synthesized by Frenzel et al. (2021/this issue). Once activated, these emotions can profoundly influence teachers' thinking, motivation, and action in the classroom, as well as their health and professional development. By implication, teacher emotions can also exert strong effects on student outcomes, including students' own emotions (Frenzel et al., 2018; Goetz et al., 2021), their wellbeing, and their achievement.

To understand the role of teachers' *self-regulation*, it may be important to consider situational constraints and the balance between self-regulation and external regulation. With few exceptions such as privately defined home schooling, teachers are not free to self-define goals for teaching or to evaluate student outcomes using self-defined standards. Rather, teaching goals are largely determined by the curriculum, and standards for evaluating outcomes are regulated by institutional practices. As such, self-regulation typically takes place in a confined space that is limited by external constraints. Again, as with motivation, this implies that variance in self-regulation may be reduced, which may make it more difficult to uncover effects on student outcomes. Nevertheless, regulation of teaching is crucial for promoting student outcomes, in terms of both external (institution-defined) regulation and teacher-defined regulation (see Kramarski & Heaysman, 2021/this issue, for the importance of teacher-defined regulation).

At the institutional level, clear definitions of the overall goals for learning and clear standards for evaluating achievement (Vogl & Pekrun, 2016) are critical to promote students' development. At the teacher level, fine-tuning teaching goals for specific classes; planning, monitoring, and adapting teaching strategies; and providing students with individual feedback may be especially important to attain favorable student outcomes. As compared with macro-level institutional regulation, these teacher-defined regulatory processes are located at more specific levels of teaching specific materials in specific groups of students. For future research on teachers' self-regulation, it may be important to investigate the interplay of institutional macro-regulation and teachers' self-directed regulation in promoting students' development.

In summary, there is more "space" for teachers' motivation, emotion, and self-regulation to influence student outcomes than indicated in the extant empirical literature. For teaching to occur, motivation is a necessary requirement, and for high-quality teaching, all three are indispensable. To better understand these effects, we need to explore mediating mechanisms, amend between-person research by within-person studies, and consider the role of socio-cultural contexts, as I will discuss next.

Mechanisms that explain teacher effects

As pointed out by Frenzel et al. (2021/this issue) and Lauermann and ten Hagen (2021/this issue), teacher effects on student outcomes are based on both intrapersonal and interpersonal processes. For teachers to have an effect on students, the minimum needed is that teachers generate some behavior, that this behavior is perceived by students, and that these perceptions influence students' own cognition, emotions, and motivation. As such, teacher effects depend on the functioning of mediating processes, and

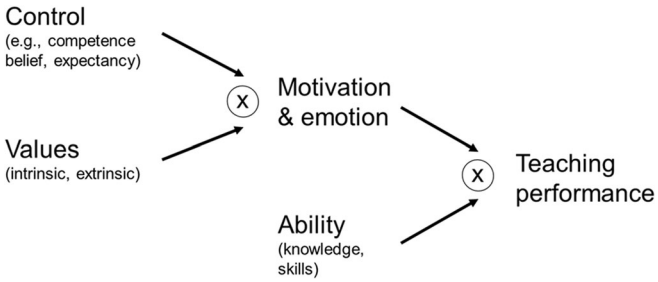

Figure 2. Simplified production model of teaching performance derived from control–value theory (Pekrun, 2021b).

research on these effects depends on adequately capturing these processes, otherwise "the signal gets lost" (Bardach & Klassen, 2021/this issue, p. 289). To make further headway in research on teacher effects, two substantive issues may be especially important (in addition to the methodological issues aptly summarized in the contributions to this special issue). First, the efficacy of any single motivational or emotional factor in generating student effects typically depends on its interplay with other factors. Second, the subsequent chain of processes may be more complex and involve more components than previously thought.

Interplay of antecedent factors

Teacher motivation, emotion, and self-regulation do not operative in isolation. Rather, they often function in combination with other variables. This is true both for the instigation of motivation and emotion, and for their effects on teacher behavior and students (Figure 2). Specifically, as addressed in expectancy-value theories of motivation (Eccles et al., 1983; Eccles & Wigfield, 2020; Lauermann et al., 2017) and control-value theory of emotion (Pekrun, 2006, 2018, 2021b; Shao et al., 2020), beliefs related to competence and control are not sufficient to generate motivation and emotion. In addition, events and actions need to be valued to trigger motivation and emotions (except for boredom which is instigated by lack of value and meaning; Pekrun et al., 2010).

For example, feeling competent alone is not sufficient to motivate a teacher to invest effort in planning a lesson. Rather, to engage in planning, the teacher also needs to consider good teaching as an important goal. Similarly, as explained in control-value theory, feeling competent alone is not sufficient for teachers to experience positive emotions during teaching; in addition, teaching needs to be valued to be enjoyable. Negative emotions also depend on the interplay of appraisals of competence and value. Teachers can feel out of control over the content knowledge needed to teach (see, e.g., Beilock et al., 2010), or over classroom management, but lack of control alone is not sufficient to prompt anxiety or hopelessness. In addition, knowing the content and managing the class need to be subjectively important to generate these emotions. If one does not care, there is no reason to be fearful (for exceptions to these rules, such as automatic generation of emotions based on procedural emotion schemas, see Pekrun, 2006; Reisenzein, 2001).

As such, research that considers competence-related beliefs alone, or value beliefs alone, may not be able to fully capture the intrapersonal causes that shape teachers' motivation, emotions, and, by implication, their self-regulation. Research on student motivation (e.g., Nagengast et al., 2011) and student emotions (Putwain et al., 2018; Shao et al., 2020) has started to examine interactions of competence and value beliefs. Research on teachers would be well advised to consider the interplay of these different beliefs in generating the motivational and emotional processes that are required to instigate action, such as high-quality teaching in the classroom.

Once emotions and motivation are generated, action may follow, but the type and quality of action do not depend on emotions and motivation alone. Again, the interplay with other factors needs to be considered. Specifically, following production models of performance as cited earlier, cognitive competencies are needed as well to successfully perform an action (Figure 2). For successful teaching, knowledge and skills are required in addition to motivation. These competencies not only comprise subject-matter content knowledge and pedagogical knowledge as traditionally considered in teacher research. In addition, executive skills may be critically important for successful teaching (working memory skills underlying attention, inhibition, switching, etc.). Future studies should consider the interplay among motivation, emotions, teaching-related knowledge and skills, and executive skills in initiating and sustaining high-quality teaching.

Mediating processes

Emotions and motivation influence the cognitive processes that result in successful teaching performance. Some of these processes are considered in models of self-regulation, including metacognitive monitoring, regulation, and evaluation of action. Processes that are less deliberate and conscious have received less recognition in these models, such as modes of attention and the activation of memory networks. Similarly, existing models of the effects of emotion and motivation on performance do not yet sufficiently capture the complexity of the processes mediating successful performance.

The effects of emotions on cognitive performance are a case in point (see also Pekrun, 2021a). The first generation of emotion-performance models, and related empirical studies, used simple, binary classifications of both emotion and performance. An example is experimental mood research that investigated differences in creative versus analytic processing in positive versus negative mood. This research failed to render consistent evidence (e.g., in some studies positive mood facilitated creative thinking, in others it rendered null effects; Baas et al., 2008; da Costa et al., 2015; Davis, 2009), suggesting that binary classifications are not sufficient. As such, researchers proceeded to use more fine-grained conceptions of either emotions or cognitive processing. An example is Pekrun's (1992, 2006) cognitive-motivational

model of emotion effects which considers both the valence and activation dimensions of emotions, and both cognitive and motivational mechanism mediating effects on performance. Another recent example is Bohn-Gettler's (2019) process–emotion–task (PET) model of emotion and text comprehension that addresses a range of different cognitive processes influenced by emotion.

However, even these models do not fully capture the complexity of emotion-performance relations. Although Pekrun's model considers both valence and activation, it does not sufficiently disentangle the differential effects of emotions within the four categories distinguished in the model (positive activating, positive deactivating, negative activating, and negative deactivating emotion). For example, enjoyment of teaching (positive, activating) is likely to facilitate teachers' on-task attention during teaching, reduce irrelevant thinking, and promote current motivation to teach. In contrast, pride about a recent promotion and joy about the salary increase (also positive, activating) might detract attention, generate irrelevant thinking, and undermine motivation to fully engage with the current class. Similarly, both Pekrun's and Bohn-Gettler's models may need to be expanded to more fully cover the multitude of cognitive processes during task performance, including teaching.

Using a bottom-up perspective on information processing from sensory perception to memory encoding, emotions can influence at least the following stages, levels, and components of processing: Sensory memory (e.g., Kuhbandner et al., 2011; Spachtholz et al., 2014); selection of information to be processed in working memory (i.e., attention); executive working memory processes like switching and inhibition; affective working memory (Mikels & Reuter-Lorenz, 2019); activation and inhibition of networks in long-term memory, including retrieval-induced forgetting and facilitation (Kuhbandner & Pekrun, 2013); assimilative and accommodative processes of integrating information and revising cognitive schemas (Fiedler & Beier, 2014); higher-level cognitive strategies such as organization and elaboration that recruit and combine various lower-level strategies; and metacognitive strategies of monitoring, controlling, and evaluating cognitive performance as addressed in models of self-regulation. Moreover, the effects of emotions on various dimensions of motivation to teach need to be considered, with motivation, in turn, also exerting profound influences on cognitive processing during teaching.

In addition, it is important to consider that emotions and motivation typically change during teaching, suggesting that effects on cognitive processing change as well. Emotional and motivational change can be due to progress in teaching contents and managing the class, but can also be achieved through emotion regulation and motivation regulation, including emotional labor (Frenzel et al., 2021/this issue). It is a task for future theory development to integrate emotion and motivation regulation into process models of teaching.

In sum, models are needed that more fully disentangle teaching performance in terms of mediating emotional and motivational mechanisms, on the one hand, and cognitive mechanisms, on the other. Similarly, models are needed that more fully explain subsequent effects of teaching on student perceptions of teaching (including perceptions of the contents taught), and of these perceptions on students' emotions, motivation, and cognitions mediating resulting outcomes. Both groups of models should consider reverse effects and principles of reciprocal causation that may help explain how students, in turn, affect teachers' motivation, emotion, and self-regulation (Bardach & Klassen, 2021/this issue; Frenzel et al., 2021/this issue; Lauermann & ten Hagen, 2021/this issue).

In developing and testing such models, it will be important to consider different levels of construct granularity, as argued by Lauermann and ten Hagen (2021/this issue). For example, cognitive processes can be conceptualized at the level of information processing within sensory, working, and long-term memory; at the level of molar strategies (such as rehearsal and elaboration, or assimilation and accommodation) that integrate lower-level strategies; and at the level of overall quality parameters, such as the use of different cognitive teaching strategies. Principles of construct symmetry (see Ajzen, 2005; Brunswik, 1955) may be considered in appropriately fine-tuning constructs: For explaining lower-level processes and outcomes, granular constructs are needed; to explain higher-level outcomes, such as teachers' overall success in teaching as reflected in student outcomes across a school year, more molar predictors may be more suitable.

Between-teacher versus within-teacher effects

Research in psychology and education, and in the social and behavioral sciences more broadly, is dominated by studies inspecting between-person distributions of variables and the links between these distributions. This is true both for non-experimental field studies and for laboratory experiments. The former use between-person covariation of variables to investigate their relations, the latter between-subject experimental designs. A major problem with this approach is that between-person data are not suited to infer any conclusions about the within-person mechanisms that explain relations between variables, except if specific conditions hold that are rarely met (ergodicity; see Murayama et al., 2017; Voelkle et al., 2014). From a methodological perspective, the reason is that between-person and within-person covariation of variables are statistically independent.

An empirical example provided by Schmitz and Skinner (1993) is the relation between duration of sleep and frequency of migraine headaches. On the between-person level, the correlation between these variables is positive, indicating that people who sleep longer suffer more from headaches. However, the within-person correlation is negative—short sleep precipitates headaches. As such, the within-person mechanism linking sleep and headaches cannot be inferred from their between-person correlation. Obviously, when misinterpreting the between-person covariation as causal evidence on the within-person mechanism, misguided

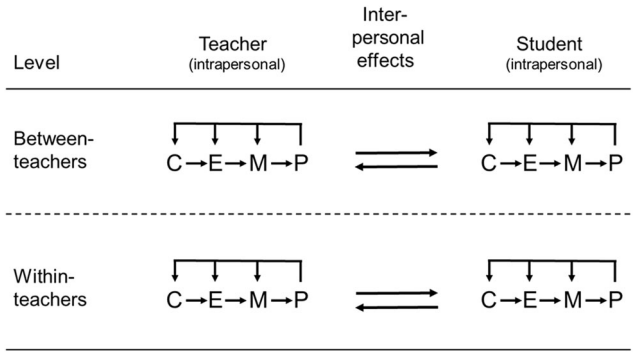

Figure 3. Two-level model of intrapersonal and interpersonal processes linking teachers and students. C, E, M, P = cognition, emotion, motivation, behavioral performance. Perception is considered part of cognition for the sake of simplicity. The model can be expanded by including additional levels, for example, to consider classrooms (with students nested within classrooms) and measurement occasions (nested within teachers, students, classrooms).

conclusions would follow not only for theory but also for practice.

Similar principles apply to research on teacher effects. However, one complication is that teacher effects on students transcend the individual—they occur between teachers and students (i.e., from teachers to students). To avoid confusion, it may be best to label these effects "interpersonal" (rather than between-person). Importantly, both intrapersonal effects and interpersonal effects can be located at the within-teacher or the between-teacher level (Figure 3). Furthermore, both teacher effects on individual students and teacher effects on whole groups of students can be conceptualized at either the within- or the between-teacher level.

Within-teacher effects imply that an individual teacher's thoughts, motivation, emotions, and actions at a given time influence students' psychological states, and that change in a teacher's state predicts change in the students' states. In contrast, between-teacher effects imply that differences between teachers generate differences between students. From a multilevel perspective, within-teacher effects are located at a lower level and between-teacher effects at a higher level. The lower-level units can consist of different measurement occasions or different students within classes (or both).

How to best interpret and model between- and within-person effects is currently a topic of controversial debate. For example, whereas some authors argue that within-person modeling is the best—or even the only—way to examine causal effects, others argue that it is important to consider both types of effects (see Orth et al., 2021). This controversy is reflected in methodological debates about how to best model causal effects. For instance, some authors argue that the classic cross-lagged panel model (CLPM) should be replaced by within-person modeling as provided by models such as Hamaker et al. (2015) random-intercept cross-lagged panel model (RI-CLPM); others argue that both models serve useful functions (see Lüdtke & Robitzsch, 2021; Orth et al., 2021; Usami et al., 2019).

From my view, decisions about conceptual and modeling approaches should depend on the research question at stake. To explain why some teachers exert more favorable effects on students than others, a between-person perspective is required. For elucidating the mechanisms that drive individual teaching and resulting student outcomes, within-teacher and within-student research is needed. As yet, however, teacher research has almost exclusively focused on between-person research, as documented in the four contributions to this special issue. This is true both for correlational teacher research and for experimental intervention studies. It is time to complement this approach by studies examining within-teacher effects and the within-person mechanisms that can explain effects of teachers on students.

Within-teacher research could expand models like the RI-CLPM to represent the complex multilevel structure of educational data, with students nested within teachers, in addition to measurement occasions nested within both students and teachers. Models like the RI-CLPM require relatively few waves, which would make it possible to reanalyze existing longitudinal teacher-student panel data using within-person modeling. Alternatively, intensive longitudinal studies including more measurement occasions (Bardach & Klassen, 2021/this issue) would offer an even broader range of methodological options.

However, both classic between-person approaches and most of the extant within-person approaches rest on the assumption that effects are generalizable across persons. For example, the RI-CLPM assumes that the cross-lagged effects linking two variables are the same across all participants (i.e., only the person-invariant part of these effects is estimated in the model). This assumption may not be valid. As such, it would be especially important to use intensive longitudinal data to model possible variation of within-teacher effects across different teachers, and across different students or classes taught by the same teacher (e.g., using dynamic structural equation modeling; Asparouhov et al., 2018).

Relative universality of teacher effects: The role of context

With few exceptions, research on teacher motivation, emotion, and self-regulation has focused on samples from Western, industrialized, rich, and democratic (WEIRD) countries. More recently, researchers have also begun to study teacher motivation in East Asian countries (see, e.g., Irnidayanti et al., 2020). However, a broader perspective on teacher motivation across the globe is still largely lacking. To what extent are theoretical principles and existing findings generalizable across sociocultural contexts?

From a theoretical perspective, generalizability can be expected for some but not all aspects of teacher motivation, emotion, and self-regulation. Specifically, as posited in control-value theory (Pekrun, 2006, 2018), the contents and process parameters of emotions and motivation typically show wide variation across persons, task domains, and contexts. For example, in terms of contents, emotions during teaching can relate to the topics of instruction (topic emotions), to one's performance in teaching the contents (achievement emotions), or to students in the classroom

(social emotions). In terms of process parameters, the intensity, duration, and frequency of emotions can also vary widely, as documented, for example, in the variation of teachers' emotions related to different groups of students (Frenzel et al., 2015). On the other hand, the functional relations of motivation and emotions with their antecedents and outcomes are thought to be universal across persons, task domains, and contexts. As such, they should also be generalizable across teachers, classes taught, and educational institutions.

For students, we found supportive evidence for these principles of "relative universality" in research on the generalizability of emotions across genders, academic domains, and cultures (for summaries, see Pekrun, 2009, 2018). For example, students' emotions in mathematics varied substantially between girls and boys, and between Chinese and German students, but their relations with students' self-confidence and performance in math were equivalent across genders and cultural contexts. Similarly, in the assessments of the OECD Programme for International Student Assessment (PISA), emotions such as anxiety in mathematics varied across genders and countries, but their relations with math performance were consistent across countries (OECD, 2013).

Principles of relative universality may also hold for the effects of teachers' motivation, emotions, and self-regulation. It is an important avenue for future research to examine variation and consistency in these variables, in their relations with student outcomes, and in mediating mechanisms across individual teachers, contents taught, diverse groups students, institutional settings, and sociocultural contexts (see also Bardach & Klassen, 2021/this issue, for the importance of considering diversity). The assessments of the OECD Teaching and Learning International Survey (TALIS), which include measures of teacher motivation such as scales assessing self-efficacy, are an important step in this direction (OECD, 2014, 2019a, 2019b).

Conclusions

Given the crucial role of motivation in the production of human behavior, motivation is indispensable for teaching and, by implication, for generating student outcomes. Similarly, although emotions and self-regulation may not always be needed, they are also likely to exert profound effects on teaching and resulting outcomes. As documented in the contributions to this special issue, research has attempted to unveil these effects, but has been only partially successful. A focus on using between-person designs and samples from single Western countries, combined with truncations and variance reductions in the variables involved, are important possible reasons. As such, future research should expand the perspective by developing and using within-teacher study designs, and by conducting cross-cultural studies. In addition, to better understand the effects of teacher motivation, emotion, and self-regulation, it will be important to consider the overlap and interplay between the three constructs and their components, to examine their interplay with teachers' knowledge and skills, and to develop more fine-grained models of the processes that link them to students' achievement, development, and health.

As argued by Bardach and Klassen (2021/this issue), interdisciplinary cooperation is needed to reach these aims. In addition to cooperation with economists and sociologists, it may also prove fruitful to collaborate with disciplines that focus on, or promote historical change. Formal, teacher-based education for whole generations is a recent accomplishment of civilization; education systems and the role of teachers underwent major change since the commencement of mandatory schooling; and they are likely to undergo further major change (e.g., due to human teaching being complemented by technology-based learning, intelligent tutoring systems, and affective educational computing). As such, the role of teacher motivation, emotions, and self-regulation is likely to undergo change as well. To understand this change, longitudinal research is needed that examines change across decades and centuries. To conduct long-term research, to better understand historical change, and to plan future change in teacher motivation, emotion, and self-regulation, collaboration with historians of education, computer scientists, and political scientists may prove especially fruitful.

ORCID

Reinhard Pekrun http://orcid.org/0000-0003-4489-3827

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