When Knowing is Not Enough – the Relevance of Teachers' Cognitive and Emotional Resources for Classroom Management

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Abstract

This study expands the discussion on teacher competence by investigating the relevance of teachers' combined cognitive resources and emotional resources for effective classroom management. While research on teacher qualification stresses the importance of knowledge for effective teaching, research on teacher stress focuses on their emotional functioning, often without connection to their in-class behaviour. Drawing on findings from health psychology showing that high levels of emotional exhaustion can impair cognitive performance, we hypothesised that teachers' pedagogical/psychological knowledge would predict their classroom management behaviour only when their level of emotional exhaustion was low. We administered a test to assess the pedagogical/psychological knowledge of 205 secondary school teachers, measured their emotional exhaustion, and assessed their classroom management using ratings of their 4,672 students obtained one year later. Data were analysed using latent moderation analyses, a novel statistical approach that rarely has been employed in research on learning and instruction. Our findings confirmed our hypotheses and indicated an interaction between teachers' cognitive resources and emotional resources, which together predict their classroom management behaviour. Thus, the new theoretical and empirical integration of two distinct areas of teacher quality broadens our understanding of teacher resources necessary for effective instruction. We argue that teacher education should acknowledge the interplay of the different resources teachers have and help them develop their emotional resources to ensure effective instruction.

Keywords: classroom management; teacher competence; emotional exhaustion; professional knowledge

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1. Introduction

There has been considerable debate in educational research about which qualities make teachers effective (e.g., Roehrig et al., 2012). From a subject-specific perspective, professional knowledge as a cognitive resource is essential (Shulman, 1986, 1987); however, some authors (e.g., Jennings & Greenberg, 2009) stress the importance of teachers' emotional resources. In this study we expand the discussion on teacher competence by investigating the relevance of teachers' combined cognitive resources and emotional resources for effective classroom management.

Teaching is a complex activity (Doyle, 2006; Helsing, 2007) in two respects. First, classrooms have unique characteristics (Doyle, 2006). For instance, the multitude of tasks which all require an adequate response from the teacher, reflects considerable multidimensionality. As many tasks occur simultaneously, teachers need appropriate monitoring and management skills. Unexpected disruptions can occur in the classroom and put constant pressure on the teacher and the teaching task (Doyle, 2006). Second, teachers need to employ several skills for effective instruction (e.g. Baumert et al., 2010). They must choose instructional tasks and appropriate methods, establish rules and structures to manage the class, and provide students with emotional as well as individual learning support (Baumert et al., 2010; Pianta & Hamre, 2009).

All these demands and practices occur simultaneously and are interconnected. Some authors argue that efficient classroom management supports learning-related activities as it structures the learning environment (Doyle, 2006; Ophardt & Thiel, 2008). The widely-used observation tool Classroom Assessment Scoring System (CLASS) considers classroom organisation to be one dimension in its framework, as it is believed to be relevant to students' academic and social development (Pianta & Hamre, 2009). Taking this into account, we focus in this study on classroom management as an important part of instructional quality.

Evertson and Weinstein (2006) defined classroom management as "the actions teachers take to create an environment that supports and facilitates both academic and social-emotional learning" (p. 4). This definition subsumes various dimensions of teacher behaviour. Empirically effective and therefore central dimensions of classroom management include monitoring students' behaviour, preventing disturbances, establishing rules, and quickly intervening during disruptions (Marzano, Marzano, & Pickering, 2003). Monitoring involves continuously observing students, which enables the teacher to prevent or detect, and possibly react quickly to, disruptions (Doyle, 2006; Kounin, 1970). Establishing rules in the classroom is an important part of classroom management (Emmer & Evertson, 2013), as these help students to regulate their behaviour. In addition, reacting adequately and quickly to disruptions is crucial (Marzano et al., 2003). Further dimensions of effective classroom management focus on the quality of student-teacher relationships and the maintenance of instructional flow (Doyle, 2006; Pianta, 2006).

Empirical evidence shows that classroom management is crucial for students in various groups and in different domains (Wang, Haertel, & Walberg, 1993). Effective classroom management is a strong predictor for students' academic outcomes (e.g. Wang et al., 1993). Yet classroom management also is related to non-cognitive outcomes such as students' motivation and interest in (Fauth, Decristan, Rieser, Klieme, & Büttner, 2014; Kunter, Baumert, & Köller, 2007), and satisfaction with, school (Nie & Lau, 2009). Further, effective classroom management can result in better student-teacher relationships (de Jong et al., 2014). However, effective classroom management is challenging, especially for young teachers, who often do not feel well prepared for the task (Liston, Whitcomb, & Borko, 2006).

To summarise, effective classroom management is crucial for students yet challenging for teachers, as it requires pedagogical, social and emotional competence as well as the ability to react quickly and appropriately in critical situations. Given the complexity of classroom management, the

question arises as to which resources—in the sense of personal prerequisites—teachers need to manage their classrooms effectively.

1.1 Necessary resources for effective classroom management

There is considerable discussion about the prerequisites for providing high quality instruction and managing the classroom effectively. In the following section we introduce two views, one stressing the importance of teachers' professional knowledge and the other stressing the relevance of teachers' emotional resources.

1.1.1 Professional knowledge – the importance of teachers' cognitive resources

One particular cognitive resource that often is considered a prerequisite for high quality instruction is professional knowledge (Depaepe, Verschaffel, & Kelchtermans, 2013; Shulman, 1986, 1987). Within this discussion professional knowledge is understood as specialised knowledge shared within a community of professionals. Research has shown that subject matter related knowledge such as *subject-specific content knowledge* and *subject-specific pedagogical content knowledge* are important for processing and communicating content related tasks (Depaepe et al., 2013; Krauss et al., 2008). Subject matter related knowledge is an important predictor for cognitive activation and student achievement (Baumert et al., 2010; Hill, Rowan, & Ball, 2005).

Regarding classroom management, subject-unspecific knowledge such as *pedagogical/ psychological knowledge*, meaning the teachers' knowledge of creating and improving classroom situations and interactions, is of great importance. Such knowledge includes that of classroom management strategies, teaching methods, classroom assessment and dealing with students' heterogeneity (Park & Oliver, 2008; Voss, Kunter, & Baumert, 2011; Voss, Kunina-Habenicht, & Kunter, 2015). Pedagogical/psychological knowledge subsumes declarative and procedural knowledge (Voss et al., 2011). The importance of this knowledge was indicated in a recent study in which teachers' pedagogical/psychological knowledge was shown to be associated with the quality of their instruction, including classroom management (Voss, Kunter, Seiz, Hoehne, & Baumert, 2014). Helping teacher candidates develop classroom management skills is therefore an essential part of teacher education (Emmer & Stough, 2001).

The assumption that teachers need cognitive resources such as professional knowledge for effective instruction thus seems well established. However, considering the great challenge that teaching may present, other researchers have argued that emotional resources are another important asset for teachers.

1.1.2 The importance of teachers' emotional resources

In their prosocial classroom model, Jennings and Greenberg (2009) claim that teachers' social and emotional resources are prerequisites for effective teaching and especially for classroom management. Following their model, teachers with sufficient emotional resources are better capable of dealing with diverse challenges in their classrooms such as effectively managing their classrooms. In the model it is assumed that effective classroom management leads to an optimal classroom climate with positive social, emotional and academic outcomes for students (Jennings & Greenberg, 2009).

Teachers' emotional resources clearly are an important topic to investigate (Sutton, 2005; Sutton & Wheatley, 2003). Teaching is an emotionally challenging profession and teachers need to be able to regulate their emotions (Roeser et al., 2013). Teachers' emotional resources have often been analysed within health psychology, focusing on how negative emotions evolve; yet few studies have analysed the relationship between teacher emotions and instructional behavior. Keller, Chang, Becker,

Goetz, and Frenzel (2014) showed that emotional exhaustion was related to teachers' emotional experience in their classrooms. Highly exhausted teachers reported increased feelings of anger and less enjoyment during instruction. Further, teacher emotions were associated with student-rated instructional quality (Frenzel, Goetz, Stephens, & Jacob, 2009). In a study testing the assumption that teachers' emotional resources are relevant to their instructional behaviour, Klusmann, Kunter, Trautwein, Lüdtke, and Baumert (2008) found that teachers who were able to balance their emotional engagement attained better instructional quality and their students reported greater motivation. Additionally, students' and teachers' emotions seem to be related (Becker, Goetz, Morger, & Ranellucci, 2014): Students who witnessed their teachers enjoying instruction also felt more enjoyment in class. Summing up, teacher emotions are a relevant resource for effective instruction.

1.1.3   Combining the perspectives: The interplay of cognitive and emotional resources

To date, researchers have investigated the cognitive and emotional resources of teachers mostly in separate studies stemming from different theoretical traditions (e.g. Brouwers & Tomic, 1999; Depaepe et al., 2013; Skaalvik & Skaalvik, 2011), neglecting a possible joint relevance for effective teaching, especially for classroom management. In our study, we combine both perspectives. Although we agree that cognitive resources such as professional knowledge are crucial for effective instruction, we argue that due to the complexity of teaching, teachers will be able to profit from their cognitive resources only if they also possess a sufficient amount of emotional resources. Thus, one the one hand, in this study we consider teachers' pedagogical/psychological knowledge as an example of their cognitive resources. On the other hand, we consider emotional exhaustion as a central aspect of teachers' emotional resources (Klusmann et al., 2008). Emotional exhaustion is the feeling of being drained or experiencing chronic fatigue and a low level of energy (Maslach & Leiter, 1999; Schwarzer, Schmitz, & Tang, 2000), and it is the core component of burnout syndrome (Maslach, Schaufeli, & Leiter, 2001). Many studies have shown that teachers generally report higher levels of emotional exhaustion than other professionals although significant differences among teachers exist (e.g., Hakanen, Bakker &, Schaufeli, 2006; Unterbrink et al., 2007).

The interdependence of cognitive and emotional resources already has been empirically demonstrated in research on health psychology. Studies comparing the cognitive functioning of highly exhausted adults and non-exhausted adults have shown that those with high levels of exhaustion had impaired cognitive functioning (Kleinsorge, Diestel, Scheil, & Niven, 2014; Sandström, Rhodin, Lundberg, Olsson, & Nyberg, 2005). In a study by Van der Linden, Keijsers, Eling, and Schaijk (2005) a non-clinical sample of exhausted teachers performed significantly lower on cognitive performance tasks than a sample of non-exhausted teachers. Feuerhahn et al. (2013) investigated the relation between emotional exhaustion and multiple indicators of performance using a sample of teachers with varying degrees of exhaustion. They found that emotional exhaustion was related to cognitive impairment. In a follow-up investigation six months later, emotional exhaustion at the first testing period predicted impairment ratings at the second testing period. However, emotional exhaustion at the second testing period was not predicted by cognitive impairment at the first testing period, meaning that emotional exhaustion leads to cognitive impairment, rather than the other way around.

Most of these studies were framed within information processing theory (e.g., Feldon, 2007; Mayer, 2012; Sweller, Van Merrienboer, & Paas, 1998) which assumes that emotional exhaustion limits information processing capacity and thus leads to poorer performance on cognitive performance tasks. Applying this to teachers, who need sufficient information processing capacities to be able to use their cognitive resources in challenging classroom situations (Feldon, 2007), one might assume that high levels of emotional exhaustion could drain processing capacities limiting the access to professional knowledge.

Further theories and approaches can be used to support our argument. Ego depletion theory assumes that self-regulation is based on a limited amount of resources (Baumeister, Gailliot, DeWall, & Oaten, 2006) and that each act of self-control exhausts these resources and leads to a state of ego depletion. Subsequent attempts at self-control or volition will fail due to a lack of available resources. Studies supporting ego depletion theory showed that after acts of self-regulation (e.g. emotional or attentional regulation) performance was impaired in tasks demanding high-order cognitive functioning (Johns, Inzlicht, & Schmader, 2008; Schmeichel, Vohs, & Baumeister, 2003). It could be argued that teachers with a high level of emotional exhaustion are in a state of ego depletion because their self-regulatory efforts have used up resources for further acts of volition (e.g., knowledge-based decisions concerning classroom management).

1.2   The present study

In this study we analyse the interaction between teachers' cognitive resources and emotional resources for classroom management behaviour. We argue that knowledge (as a cognitive resource) and emotional exhaustion (as an emotional resource) are interconnected when it comes to predicting teachers' behaviour as emotional exhaustion might limit capacities to process knowledge. Classroom management behaviour such as monitoring or preventing disturbances relies on cognitive resources as it requires quick reactions to the unforeseen (e.g., Feldon, 2007). We hypothesize that the successful application of knowledge in challenging classroom situations requires sufficient information processing capacity, but that high emotional exhaustion will reduce these processing capacities, thus limiting teachers' access to knowledge. Only when teachers possess sufficient emotional resources will they have enough capacities to apply knowledge-based strategies to manage the classroom. To our knowledge, this is the first study that combines cognitive and emotional resources of teachers to predict their in-class teaching behaviour.

1.3   Hypotheses

Methodologically, we thus investigate whether teachers' emotional exhaustion moderates the relation between their professional knowledge and their classroom management behaviours, as indicated by their prevention of disturbances and their monitoring behaviour. We hypothesise as follows:

[1] Pedagogical/psychological knowledge will not predict:
  a)   classroom disturbances when the level of emotional exhaustion is high.
  b)   monitoring behaviour when the level of emotional exhaustion is high.
[2] When the level of emotional exhaustion is low, pedagogical/psychological knowledge will relate:
  a)   negatively to classroom disturbances.
  b)   positively to monitoring behaviour.

2.   Method

2.1   Design and sample

The data used in this study were derived from a larger longitudinal study investigating the development of secondary school mathematics teacher candidates' professional competence during and after the practical induction phase. The practical induction phase is mandatory in Germany and follows university studies. During this phase teacher candidates are placed in schools where they observe instruction and gradually start their own teaching. In addition, they attend courses on general principles of teaching.

Two assessments of this study were used for this analysis. The first assessment involved 568 participants and was conducted at the end of the participants' induction phase. In this assessment, pedagogical/psychological knowledge and emotional exhaustion were assessed. The aim of the second assessment was to gather data on instructional quality (rated via students) of the participants after they had taken over full teaching responsibilities. Therefore, the second assessment was conducted 14 months after the end of the induction phase to ensure that participants were already established as teachers. In this assessment 205 teachers and their students still participated. In our study we aimed at predicting student- rated quality of classroom management using prior teacher resources. Therefore we used this subsample of 205 teachers of the second assessment as our sample of analysis.

Our sample was 61% women and the average age of the participants was 28.4 years (SD = 3.74) at the first assessment. Participants had on average 14 months of teaching experience when the data were collected at the second assessment. Germany has a tracked school system with a high, an intermediate and a low track. These different school types were represented in the sample; however, the sample was slightly skewed as 61.3% of the participants taught the highest school track. In 2013/2014, 47% of all students in Germany attended the highest school track (Statistisches Bundesamt, 2014).

We analysed the demographic variables (age, sex and school type) and self-reports on motivation and exhaustion of the dropouts from the two different samples of the longitudinal study. Participants of the second assessment taught more in the higher school track, were more enthusiastic and satisfied with their jobs, and showed less emotional exhaustion. Thus, the generalisability of our results may be somewhat compromised.

In addition, 4,672 students from grades 7 to 10 participated in the second assessment and were included in our analyses. On average 12 students rated the classroom management of each teacher. Teachers were allowed to have up to five classes participate in the ratings. However, ratings from all the classes of each teacher were combined, as they revealed high correlations across classes and our focus was on the teacher.

A different analysis of this data focussing on the importance of pedagogical/psychological knowledge for general instructional quality based on a different teacher sample already has been published (Voss et al., 2014). The focus of this investigation is the relevance of the interplay between different teacher resources and how this interplay affects classroom management, which has not yet been the subject of investigation. Including emotional exhaustion as a moderator expands existing research and allows testing more differentiated hypotheses on the relevance of teachers' professional knowledge.

2.2 Measures

We applied confirmatory factor analysis and structural equation modeling. The scales and items described represent the multiple indicators for the latent factors. Table 1 provides an overview of the descriptive data and the reliabilities of the measures based on the raw dataset. The remainder of the analysis refers to the latent dimensions of the variables. Table 2 provides an overview of the fit indices of the measurement models; Appendix A displays information on factor loadings of the indicators on the respective factors.

Table 1

Psychometric properties of study variables

Variables	Items	*M*	*SD*	ICC_1	ICC_2	ADM	α	Missing in %
Teacher ratings								
Pedagogical/psychological knowledge	39	73.37	11.45	—	—	—	.79	19.5
Emotional exhaustion	4	2.02	.64	—	—	—	.81	8.3
Student ratings								
Classroom disturbances	6	2.17	.74	.33	.92	.70	—	.6
Monitoring	3	2.85	.65	.23	.87	.64	—	.7

Note. Student ratings based on teacher mean scores. ICC = intraclass correlation, ADM = average deviation index, averaged across all classes of each teacher.

2.2.1 Pedagogical/psychological knowledge

To assess teachers' pedagogical/psychological knowledge we employed a test that had been used and validated in previous studies (Voss et al., 2011; Voss et al., 2014). The test consists of four scales measuring knowledge of classroom management, teaching methods, classroom assessment and students' heterogeneity. Test construction and validation analysis indicated that the scales are well represented by a second order factor expressing general pedagogical/psychological knowledge (Voss et al., 2011); thus we used the scales as indicators of one latent factor. Altogether, the measure consists of 39 items across the four subscales including multiple-choice, short-answer and video-based items (Voss et al., 2011). The multiple-choice items assessed declarative knowledge whereas procedural knowledge also was assessed using video-based items on classroom management. Pedagogical/psychological knowledge as measured by this test has proven to be differentiable from discriminant constructs such as general reasoning ability, pedagogical content knowledge and teacher beliefs about mathematics learning and teaching (Voss et al., 2011).

2.2.2 Emotional exhaustion

We used an established German version (Enzmann & Kleiber, 1989) of the Maslach Burnout Inventory (Maslach, Jackson, & Leiter, 1996) to assess teachers' state of emotional exhaustion. The

instrument consists of four items and participants rated their agreement with statements (e.g., "I often feel exhausted at school") on a 4-point response scale (1 = strongly disagree, 4 = strongly agree).

Table 2

Fit indices of individual and combined measurement models without interaction term

Model	χ^2	*df*	*p*	CFI	RMSEA	SRMR (between)	SRMR (within)
Teacher ratings							
Emotional exhaustion	8.57	2	.01	.97	.03	.03	—
Pedagogical/ psychological knowledge	6.85	2	.03	.94	.03	.04	—
Student ratings							
Classroom disturbance	173.42	18	.00	.98	.04	.03	.03
Monitoring	.00	0	1.00	1.00	.00	.00	.00
Measurement models without interaction term							
Model 1	277.93	94	.00	.98	.02	.05	.03
Model 2	75.24	49	.01	.98	.01	.06	.00

Note. CFI = Comparative fit index; RMSEA = root-mean-square error of approximation; SRMR = standardized root-mean-square residual. Dashes indicate nonavailable data. The monitoring model is saturated.

2.2.3 Classroom management

There are several methods to assess instructional quality: teacher ratings, student ratings or ratings of external observers (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009). We measured the quality of classroom management with students' ratings to avoid shared method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and because several studies have indicated that students are a reliable and valid source for judging instructional quality (e.g., Fauth et al., 2014; Lüdtke, Trautwein, Kunter, & Baumert, 2006). Research suggests that teacher and student ratings of classroom management are highly congruent (e.g. Kunter & Baumert, 2006).

Students responded to all classroom management items using a 4-point Likert scale (1 = strongly disagree, 4 = strongly agree). Classroom disturbances were assessed using six items (e.g., "In mathematics class it takes a long time at the beginning of the lesson until the students have settled down and started working"), giving examples of wasting time in class and student disruptions. A high score on this scale represented a high rate of classroom disturbances. Monitoring was assessed using three items (e.g., "In mathematics our teacher always knows what is going on in the classroom"). Both scales were developed in a previous project (Baumert, Gruehn, Heyn, Köller, & Schnabel, 1997) and have been validated in several other studies (e.g., Kunter et al., 2007). Two-level confirmatory factor

analysis and model difference tests revealed a significantly better fit for a two-factor model of the two aspects of classroom management than for a global factor.

To estimate whether the individual student ratings can be conceptualised as indicators for behaviour on the teacher level, we followed recommendations by Marsh et al. (2009). The reliability and agreement of the ratings on the teacher level was calculated using intra-class correlations (ICC) and the average deviation index (AD_M) of the manifest scales (Lüdtke et al., 2006). The ICC_1 indicated the amount of variance among groups; in our case it reflected differences in classroom management ratings among teachers. The ICC_2 described the reliability of the group-mean rating of the whole scale, taking into account the number of raters. It can be interpreted in a similar manner as Cronbach's alpha. The AD_M is a means for assessing agreement within the group. It represents the average individual deviation from the group mean and is expressed in the metric of the original scale.

There were substantial differences in ratings of classroom disturbances ($ICC_1 = .33$) and monitoring ($ICC_1 = .23$) among the teachers in our sample. Both scales showed good reliability on the class level (classroom disturbances $ICC_2 = .92$; monitoring $ICC_2 = .87$). The AD_Ms were at .70 for classroom disturbances and at .64 for monitoring, indicating good agreement, with average individual ratings differing less than one point of the scale from the group mean.

2.2.4   Control variable

School type was included as a control variable on the teacher level (dummy coded: high track versus lower tracks).

2.3   Statistical analysis

Our data has a hierarchical structure with students being nested in teachers. We therefore analysed the data using multilevel modeling, which overcomes the violation of the independence of observations and produces correct standard errors (Hox, 2010). Teacher resources were assessed on the teacher level. Ratings of classroom management were assessed on the student level. We chose the teacher level and not the class level as our unit of analysis, since our focus is on the relevance of teacher resources. We combined multilevel modeling with structural equation modeling, thus correcting measurement errors. All constructs were estimated as latent factors with multiple indicators using Mplus (Muthén & Muthén, 1998-2010). In our analysis, classroom management was modeled as a latent factor simultaneously on the individual level and the teacher level. With this doubly latent approach we followed the recommendations by Marsh et al. (2009), correcting measurement error on both levels as well as sampling error on the teacher level.

To test our hypotheses that the relation between pedagogical/psychological knowledge and classroom management is moderated by teachers' exhaustion, we used the latent moderation structural equation approach (LMS; Klein & Moosbrugger, 2000) implemented in Mplus. By using latent predictors and calculating the interaction term of latent predictors we overcame the problem of manifest moderation analysis, in which the multiplicative term is affected particularly by measurement error (Klein, 2000). The LMS approach corrects measurement error in the predictor terms as well as in the multiplicative interaction term, leading to unbiased estimates for interaction effects. Following the suggestion of Klein and Moosbrugger (2000), the latent factors were entered as predictors and then a multiplicative term of these two latent factors was formed, resulting in the following equation for the between-level (Schermelleh-Engel, Kerwer, & Klein, 2014):

$$\eta_B = \alpha + \gamma_{1B}\xi_{1B} + \gamma_{2B}\xi_{2B} + \gamma_{3B}\xi_{1B}\xi_{2B} + \zeta_B \qquad (1)$$

This analytical approach is relatively new, computationally intensive and has rarely been applied in research on learning and instruction. We calculated two separate models for each aspect of classroom management due to the computational complexity.

The rate of missing values was acceptable for most variables (0.7 % for student ratings; 8.3 % for emotional exhaustion) except for pedagogical/psychological knowledge (19.5 %; see Table 1). This test was conducted only in the first assessment. The high percentage of missing data for the knowledge scores emerged as not all teachers participating in the second assessment (our sample of analysis) had completed the knowledge test in the first assessment. We analysed the selectivity of teacher respondents vs. non-respondents regarding demographic variables and teachers' emotional exhaustion. Because there were no significant differences between these groups and thus no indication for systematic missing values (Schafer & Graham, 2002), we used the effective full information maximum likelihood (FIML) algorithm (Enders & Bandalos, 2001) to estimate missing values in the following analysis. All significance testing was undertaken at the .05 level.

For the calculation of practical effect sizes of multilevel analysis the following formula was employed (Reyes, Brackett, Rivers, White, & Salovey, 2012): $\delta = \frac{\gamma}{\sqrt{\tau_{00}+\sigma^2}}$. While γ is the association between predictor and outcome variable, τ_{00} and σ^2 are the between- and within-group variances of the outcome variable (from the unconditional model). Reyes et al. (2012) states that δ can be interpreted similarly to Cohen's (1988) *d*.

3. Results

3.1 Preliminary analysis

We conducted zero-order correlations on the teacher level between all latent factors involved in the analysis (see table 3).

Table 3

Latent standardized correlations of the study variables

Variables	1	2	3	4	5
Teacher ratings					
1 Pedagogical/psychological knowledge	—	-.18	-.10	.11	.22*
2 Emotional exhaustion		—	.02	.04	-.05
Student ratings					
3 Classroom disturbances			—	-.78*	-.11
4 Monitoring				—	-.29*
5 School type					—

Note. School type is dummy-coded: high track versus low track.

* $p < .05$.

3.2   Results of the latent moderation models

After our preliminary analysis, we calculated two separate models of latent interaction. Pedagogical/psychological knowledge and the moderator emotional exhaustion were entered as predictors. Then the multiplicative term of the two latent factors pedagogical/psychological knowledge and emotional exhaustion was added as the third predictor. The dependent variables were either students' ratings of classroom disturbance or monitoring-ratings. We controlled for school type by including it as an additional predictor in the models.

Although fit indices for the LMS approach have not yet been developed (see Table 2 for fit indices for the measurement models without interaction term), it is possible to test the models with interaction effect against models without interaction effect using log likelihood differences, which are χ-distributed (Klein & Moosbrugger, 2000). The results of the difference tests revealed that the models with interaction term fit the data significantly better than models without interaction term, indicating that a significant interaction effect existed in both models (see Table 4).

Table 4

Latent regression on teachers' classroom management behavior with pedagogical/psychological knowledge as predictor and emotional exhaustion as moderator

	Model 1		Model 2	
	Classroom disturbances		Monitoring	
Variable	b (SE)	δ	b (SE)	δ
Intercept	2.24 (.04)		2.63 (.03)	
School type	-.08 (.08)	-.11	-.22*(.06)	-.63
Pedagogical/psychological knowledge	-.03 (.06)	-.04	.06 (.04)	.17
Emotional exhaustion	.06 (.05)	.09	-.04 (.04)	-.12
PPK x EE	.11*(.01)	.16	-.10*(.03)	-.29
R²	.07		.14	

Note. Model fit indices for LMS not yet provided by Mplus. PPK = Pedagogical/psychological knowledge; EE = Emotional exhaustion; *b* = unstandardised regression coefficient; *SE* = standard error; δ = effect size.

 * *p* < .05.

The effect sizes for the interaction effects can be considered small. Following recommendations by Aiken and West (1991) we plotted the interactions using different levels of the moderator. The three slopes represent different levels of the moderator emotional exhaustion (one standard deviation below the mean, the mean, and one standard deviation above the mean; see figures 1 and 2). Additionally, we tested whether the simple slopes differed significantly from zero, meaning that the slope for the chosen value of the moderator was significant. Since the interactions were disordinal, there can be no valid interpretation of the main effects (Aiken & West, 1991).

For the prediction of monitoring there also was a significant interaction between knowledge and emotional exhaustion. Testing the simple slopes revealed that only the slope for a large amount of knowledge and a low level of emotional exhaustion was significant (see figure 2), indicating that only teachers with a high level of knowledge experiencing a low level of exhaustion showed better monitoring.
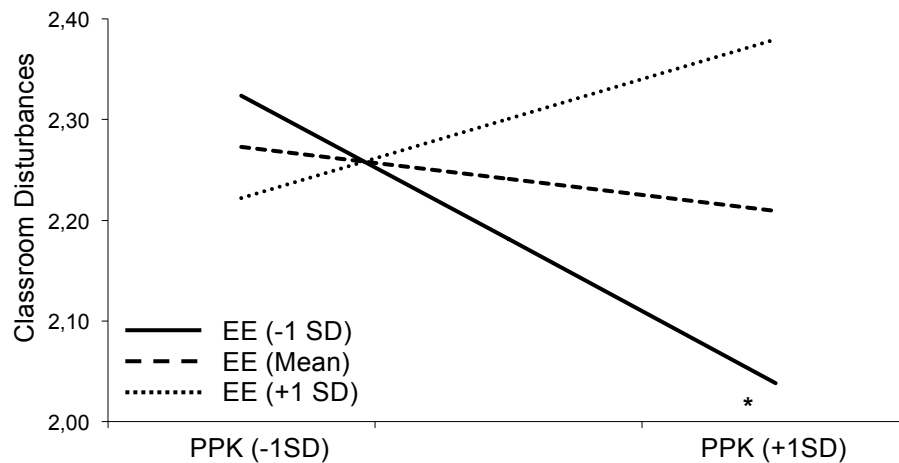
* *p* < .05.

Figure 1. Interaction effect of pedagogical/psychological knowledge (PPK) and emotional exhaustion (EE) on classroom disturbances
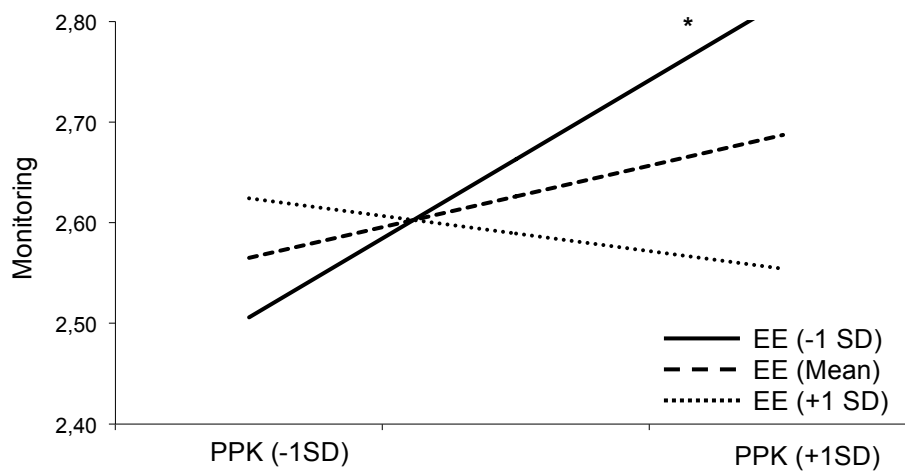
* *p* < .05.

Figure 2. Interaction effect of pedagogical/psychological knowledge (PPK) and emotional exhaustion (EE) on monitoring

4. Discussion

The aim of this study was to analyse the joint relevance of teachers' cognitive and emotional resources for classroom management. By analysing the distinct interplay of these resources we extended research in the area of teacher competence. Our results indicate that neither cognitive nor

emotional resources alone are linked to students' ratings of classroom management, as there were no significant bivariate correlations or main effects. Still, significant interaction effects illustrate that teachers' cognitive and emotional resources interact.

The results of both interaction models reflect the hypothesised mechanism of interplay between the resources: Only the combination of knowledge and a low level of emotional exhaustion is associated with ratings of effective classroom management (a low level of classroom disturbances or a high level of monitoring). These results confirm hypotheses 2a and 2b. However, knowledge does not predict classroom management when the level of emotional exhaustion is high or average (hypotheses 1a and 1b).

Our results indicate that pedagogical/psychological knowledge alone may not be sufficient for effective classroom management but rather that cognitive and emotional resources are synergistic: Only the combination of resources results in better classroom management. These results could be interpreted as potential support for our theoretical argumentation following information processing theory. A high level of emotional exhaustion may influence teachers' information processing capacity and consequently teachers will not be able to process their knowledge extensively. In a similar vein the results can be interpreted through the lens of ego depletion theory. Teachers experiencing high emotional exhaustion need to intensively regulate their emotions during instruction (Näring, Briët, & Brouwers, 2006). This emotional labour may deplete volitional resources for consecutive higher-order cognitive activities, like applying professional knowledge in challenging classroom situations. No matter which theoretical approach is followed, processing of knowledge fails if teachers are highly exhausted, and classroom management is less effective.

Our study integrated several innovative aspects. First, we combined two theoretical approaches to teacher competence, which have not yet been brought together empirically. Through analysing the interaction of cognitive and emotional resources we aimed to detect relevant psychological processes influencing teacher behaviour. Second, with our test of teachers' pedagogical/psychological knowledge we introduced an objective and direct measure of teachers' cognitive resources, and thus went beyond subjective or distal measures (e.g., course work) to assess teacher knowledge. Third, we applied an advanced methodological approach by using latent moderation analysis with multilevel data which rarely has been applied in educational research but overcomes problems of measurement error of the multiplication term (Klein, 2000).

4.1   Limitations and areas for future research

Some limitations of this study need to be considered. First, the causal direction of our argumentation and interpretation of our results needs further proof. Due to our longitudinal design and the temporal ordering of our variables we concluded that the interplay between knowledge and emotional exhaustion has an effect on later classroom management and that prior teacher resources cannot be affected by later classroom management problems with the classes that provided the ratings; however, we were not able to control prior levels of classroom management. There are several studies indicating that teacher stress and emotional exhaustion may be a consequence of problems with classroom management, and thus reciprocal effects seem likely (e.g., Chaplain, 2008; Dicke, Parker, Marsh, et al., 2014). Further, problems with classroom management may also impact student's functioning and behavior (Helmke & Renkl, 1993; Luckner & Pianta, 2011), which then may influence teachers' in-class experiences and thus affect teachers' resources in return. The relation of teacher resources, classroom management and student functioning is much more complex and our study was only able to focus on some of these relations. More research and different designs are needed to disentangle the different relations, especially between classroom management and teachers' emotional resources. Studies using cross-lagged designs could help researchers approach this question.

As our results remained stable when using ratings of emotional exhaustion of the second assessment, they can also support our argumentation. However, the fact that the time interval between the first and the second assessment was 14 months needs to be considered an additional limitation as pedagogical/psychological knowledge is likely to still change after the induction phase.

Further, another study based on a different teacher sample showed a direct association between pedagogical/psychological knowledge and classroom management (Voss et al., 2014), which contrasts with our findings. This study assessed teacher knowledge data at the beginning of the induction phase, using a slightly different subsample. We conducted several analyses in order to interpret these differences. As participants did not differ substantially and the knowledge test was invariant across measurements we conclude differences in results to be on the conceptual level. Apparently, during the evolvement of the induction phase and the beginning of regular teaching emotional functioning becomes more important, explaining our findings of interaction effects and our lack of main effects.

Further, in our study, we combined two approaches to assessing teacher resources focusing on their professional knowledge and emotional exhaustion. However, there are other relevant aspects of teacher competence such as motivational orientations, and other domains of their cognitive resources such as beliefs (Baumert & Kunter, 2013). Some researchers already have approached the question as to how different competence aspects influence each other (Dicke et al., 2014; Klusmann, Kunter, Voss, & Baumert, 2012). However, we argue that instead of analysing these associations with regard to teacher variables as outcomes it would be interesting to study the additional impact of these interplays on instructional or student outcomes.

In general, alternative explanations for the results might be applied. For instance, it would be possible that teachers high in pedagogical/psychological knowledge are very self-efficacious regarding their classroom management. These favourable motivational orientations could also help to apply knowledge during instruction, resulting in effective classroom management (Morris-Rothschild & Brassard, 2006).

Regarding the generalisability of our results we need to point out some specific characteristics of our sample. First, our sample was not representative. Second, our sample consisted of secondary school mathematics teachers and their students. As our research question was not subject-specific we would expect similar results in samples of teachers of other subjects. Third, our sample included teachers with relatively little teaching experience. Since we based our arguments on information processing theory, our results need to be interpreted with caution: research has shown differences in information processing between expert and novice teachers (Swanson, O'Connor, & Cooney, 1990; Wolff et al. 2014). More experienced teachers possess more automatised routines and schemas which claim less information processing capacity (e.g., Feldon, 2007). Further, differences between experts and novices in terms of classroom management exist in their perceptions of classroom events, in that novices have problems noticing simultaneous class events (Van den Bogert, Van Bruggen, Kostons, & Jochems, 2014). This could be interpreted in a way that that classroom management claims more information processing capacity from novices than from experts (Sabers, Cushing, & Berliner, 1991). According to such findings it is possible that the joint relevance of teacher resources analysed in this study could apply especially to teachers with little experience and thus may be overestimated in our sample. Also, it could be that experienced teachers' emotions differ from those of less experienced teachers when reacting to classroom management situations (Sutton & Wheatley, 2003). It would be highly recommendable for future studies to explore this relation with samples of more experienced teachers.

4.2   Theoretical and educational implications

Teaching is challenging and our results show that resources of successful teachers interact in complex ways. We argue that this expanded view on teacher resources is highly relevant for teacher education and pedagogical practice. Teacher education aims to prepare students for their professional career, yet the understanding of teacher resources focuses foremost on teachers' professional and practical knowledge (Korthagen & Kessels, 1999). Also, teacher selection programs often focus on knowledge, yet our results indicate that knowledge alone might not be sufficient. We argue for a combined approach in teacher education that focuses on the development of professional knowledge as well as on teachers' emotional resources.

Several authors highlight the importance of acknowledging teaching as an emotional practice (Chang, 2009; Sutton & Wheatley, 2003).Teachers' emotional resources are also relevant for students. Students profit from having warm and highly supportive student-teacher interactions in regard to their academic development, self-regulation and their executive control (e.g. Roorda, Koomen, Spilt, & Oort, 2011; Williford, Whittaker, Vitiello, & Downer, 2013). As emotions often emerge in various classroom situations regulation of emotions is especially relevant for effective classroom management (Sutton & Wheatley, 2003). Nevertheless, little is known about teachers' emotional processes in such situations (Chang, 2009). Chang (2013) showed that the appraisal of classroom incidents involving problematic student behaviour is related to unpleasant emotions, which are associated with burnout. This association between negative emotions and burnout was in turn mediated by different coping strategies. Chang (2009) argues that teachers should learn to regulate their emotions by using reappraisal techniques and coping mechanisms.

Another way to help teachers deal with their emotions has emerged. Mindfulness training programs equip teachers with techniques to integrate mindfulness skills in the classroom (Flook, Goldberg, Pinger, Bonus, & Davidson, 2013) and thereby cope with stress more effectively (Roeser et al., 2013). After completing a mindfulness training program, participants showed fewer burnout symptoms, performed better on attentional tasks and even organised their classrooms better than those in a control group (Roeser et al., 2013).

It would seem beneficial to incorporate such training on emotion regulation in teacher education and professional development programs. Helping teachers understand their emotions and enhance their competence in regulating them certainly would not replace teachers' professional knowledge; however, knowledge of classroom management strategies may help teachers prevent later exhaustion (Dicke et al., 2015; Klusmann et al., 2012). We argue that teacher education and continuing professional development programmes would profit from broadening their scopes and acknowledging the relevance of cognitive and emotional aspects of teacher competence and their potential interplay. Helping teachers address their emotions during teacher education and continuously supporting them in doing this through professional development would have two benefits: synergies between teachers' cognitive and emotional resources may be promoted, enabling teachers to make the most use of their knowledge in the classroom; and, in the long run, work-related stress and burnout may be lessened or even avoided.

Keypoints

- Teachers' cognitive and emotional resources interact.
- Teachers' knowledge is not related per se to ratings of classroom management.
- Teachers' knowledge predicts classroom management only when emotional exhaustion is low.

Acknowledgments

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APPENDIX A

Standardized factor loadings of latent factors

Factors and Indicators	Factor loadings (within level)	Factor loadings (between Level)
Emotional Exhaustion		
I often feel exhausted at school.	—	.79
As a whole, I feel overworked.	—	.65
I often notice how listless I am at school.	—	.70
I sometimes feel really depressed at the end of a school day.	—	.75
Pedagogical/ psychological knowledge		
Teaching methods	—	.72
Classroom management	—	.35
Classroom assessment	—	.56
Students' heterogeneity	—	.56
Classroom Disturbance		
In mathematics teaching is very often interrupted.	.75	.99
In mathematics students talk among themselves the whole time.	.76	.99
In mathematics students mess around the whole time.	.70	.98
In mathematics it takes a very long time at the start of the lesson until the students have settled down and started working.	.60	.95
In mathematics a lot of lesson time is wasted.	.63	.95
In mathematics the lesson often starts late.	.42	.82
Monitoring		
In Mathematics our teacher always knows what is going on in the classroom.	.44	.87
In mathematics our teacher always checks our homework thoroughly.	.60	.68
In mathematics our teacher makes sure that we pay attention.	.45	.95

Note. All loadings were significant at $p < .05$.