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**Teacher Self-Efficacy and Self-Reported Instructional Quality: A Multilevel
Perspective on the Role of School Characteristics**

Doris Holzberger^{1a*} & Elisabeth Prestele^{2a}

¹Centre for International Student Assessment, TUM School of Education; Technical
University of Munich, Munich, Germany

²University of Koblenz-Landau, Germany

^aBoth authors have contributed equally to the manuscript.

*Corresponding author. Doris Holzberger, Centre for International
Student Assessment, TUM School of Education, Technical University of Munich, Arcisstraße
21, 80333 Munich, Germany. Tel: +49-89-289-28278. E-mail address:
doris.holzberger@tum.de.

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Abstract

In the present study, we investigated the associations between teacher self-efficacy with their self-reported instructional quality (i.e., cognitive activation and classroom management) from a multilevel perspective. We focus on the interplay between self-efficacy and school characteristics, namely collective efficacy, collaboration, instructional leadership, and participation. Austrian TALIS 2018 data from 4,255 teachers at 246 schools were analyzed. Multilevel analyses revealed that relationships between teacher self-efficacy and self-reported instructional quality can be found at the teacher and school levels. For self-reported cognitive activation, no context effects or cross-level interactions were found for school characteristics. With regard to classroom management, it makes a difference whether the same teacher is situated in a low- or a high-efficacy school (context effect). Also, non-systematic cross-level interactions were found for the relationship between self-efficacy and classroom management. The findings indicate the differential importance of addressing the school context when investigating teacher self-efficacy and instructional quality.

Keywords: teacher self-efficacy; school characteristics; instructional quality; context effect; multi-level analysis

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1. Introduction

Extant research on teacher motivation has been consistently increasing and has identified teacher motivation as a relevant predictor of positive educational outcomes, such as student engagement, instructional quality, and teacher job satisfaction (e.g., Frenzel et al., 2015; Klassen & Chiu, 2010). Studies on teacher motivation, which have been dominated by an individual teacher perspective, investigate how teachers' individual motivational characteristics are related to consequences as well as to antecedents. As (most) teachers teach their classes individually, this individual perspective is legitimate. Nevertheless, as they interact with colleagues and collaborate with their principals, teachers operate in certain ways based on the schools at which they teach. Therefore, the school context and how school characteristics interact with teachers' personal motivational characteristics cannot be neglected (Harris & Rutledge, 2010).

More than a decade ago, Woolfolk Hoy (2008) called for addressing contextual factors when investigating teacher motivation. In the general working context, Chen and Kanfer (2006) proposed a model in which work motivation as well as the relationship between work motivation and work performance are modeled both on the individual and the group level. Accordingly, teacher motivation not only constitutes an individual variable but teachers' motivation at a school may also serve as a relevant school characteristic. Although Chen and Kanfer (2006) highlight that an individual's motivation interacts with the group level motivation, research on teacher motivation has not yet addressed these interactions. Further, Gitomer and Bell (2013) as well as Youngs et al. (2015) claim that research on teachers' instruction needs to address school context characteristics. In the present study, we examined whether the relationship between teacher self-efficacy (as indicator for teacher

motivation) and self-reported instructional quality at the individual teacher level can be established at the school level as well. We modeled teacher self-efficacy as not only an individual variable but also as a composite school variable and examined whether the school motivational context as well as other school characteristics (i.e., collaboration, leadership, and participation) make a difference. Thus, we aimed to gain more differential knowledge on how the relationship between individual teacher motivation and self-reported instructional quality may be affected by school variables.

1.1 Teacher Efficacy and Instructional Quality: A Multilevel Relationship?

In the present study, we focus on teacher efficacy as a well-established motivational construct. Teacher self-efficacy can be defined as an individual's belief in his or her capacity to execute specific behaviors (see, e.g., Bandura, 1997). With this definition, teacher self-efficacy is theoretically assumed to determine behavior. With regard to teaching behavior, multiple aspects of instructional quality can be distinguished (for an overview, see Klieme et al., 2009; Pianta & Hamre, 2009). In the present study, we focus on cognitive activation and classroom management. Cognitive activation aims at students' understanding and has been shown to predict student achievement (Baumert et al., 2010). Classroom management describes efficient time use and an orderly classroom environment, monitored by the teacher (Emmer & Stough, 2001), and has been shown to be related to cognitive as well as emotional student outcomes (Kunter et al., 2013).

Domain-specific aspects of teacher self-efficacy have been established comparable to those of instructional quality. Tschannen-Moran and Woolfolk Hoy (2001) developed a scale that separates teaching efficacy for student engagement, instructional strategies, and classroom management in order to touch the domain- and task-specific nature of efficacy beliefs. In line with the present focus on cognitive activation and classroom management as

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indicators for instructional quality, we chose teacher efficacy in instruction and in classroom management as relevant motivational predictor variables.

A multitude of empirical findings in the last few decades have revealed relationships between teacher efficacy and outcome behaviors (see Klassen and Tze (2014) and Zee and Koomen (2016) for review articles). Recently, Lazarides et al., (2020) as well as Buric and Kim (2020) found positive relationships between teacher self-efficacy and their self-reported instructional quality and engagement. The vast literature on teacher motivation and more specifically on teacher efficacy, however, examines teacher self-efficacy almost exclusively on the teacher/class level and rarely addresses the school level.

Teachers are embedded within the organizational context of a school, led by a principal, and filled with interactions with colleagues. Teachers form a “collective system by which team members coordinate direction, intensity, persistence of efforts” (Chen & Kanfer, 2006, p. 233). To address motivation at the group level, Bandura (1997) introduced the concept of collective efficacy as “a group’s shared belief in its conjoint capabilities” (p. 477) for attaining a specific goal. According to Bandura (1997), this belief in conjoint capabilities can be measured in two ways: (1) individual appraisals of *personal* capabilities aggregated to the group level and (2) individual appraisals of the *group* capability aggregated at the group level. While teacher collective efficacy has been shown to be related to several outcome variables, such as teacher’s job satisfaction (Klassen, 2010), teacher collaboration (Meyer et al., 2020), or student achievement (Goddard et al., 2000), little is yet known about its association with instructional quality.

Although there has been almost no empirical research on the relationship between teacher self-efficacy and instructional quality at the school level, there are several theoretical frameworks that delineate motivational processes and their relationship with performance, both at the individual and group levels (Chen & Kanfer, 2006; DeShon et al., 2004). The lack

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of empirical research may be due to the fact that the conceptualization of “team instructional quality” is not as straightforward. Nevertheless, within school evaluation, aggregated instructional quality ratings are used in order to assess school quality and thus can be conceptualized as a relevant performance outcome (Gitomer & Bell, 2013; Taut & Rakoczy, 2016). Although the main variance in instructional quality is within schools, research found that there is a small significant amount of variation at the school level (Hill et al., 2015; Wenger et al., 2018).

In order to find out more about the role of the school as an organizational unit and the interactions among teachers, it is crucial to separate the teacher level from school-level associations with relevant outcome variables. Therefore, in order to understand whether teacher self-efficacy has comparable associations with relevant outcome variables on the teacher as well as the school level, we apply a multilevel perspective and address teachers’ self-efficacy both as a variable related to individual teachers’ self-reported instructional quality and as a school-level variable related to school performance (pure Level 2 associations).

1.2 School Context Effects on Instructional Quality

When we address teacher motivation and instructional quality from a multilevel perspective, the question is not only whether relationships at the teacher as well as at the school level are similar. We also have the opportunity to investigate whether the context in which teaching takes place is related to the individual’s performance beyond the teacher’s individual self-efficacy (unique context effect). Therewith, it would be assumed that instructional quality is not only predicted by individual teacher self-efficacy, but also that school variables have an effect over and above that. In other words, teachers with the same level of self-efficacy may differ in their self-reported instructional quality depending on which school they are in.

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Several school characteristics have been assumed to predict instructional quality (Hill et al., 2015; Maag Merki et al., 2015). While even school effectiveness research itself lacks a clear theory of how school characteristics affect teaching, it has been referred to as a multilevel framework (Scheerens, 2015). As conceptualized in these models, it is reasonable that school variables, such as principal leadership or collaboration among colleagues, affect teachers' instructional quality. For example, principals may collaborate with teachers in order to solve classroom problems, may introduce new teaching ideas, or provide feedback on classroom observations. These interactions with the principal have been defined as "principal instructional leadership" and may affect instructional quality independent of a teacher's individual self-efficacy (Hallinger et al., 1996; Krüger et al., 2007). Moreover, colleagues may interact on instructional and assessment strategies, collaborate regarding lesson planning, exchange materials, or discuss strategies for efficient classroom management and for handling disruptive students (Ronfeldt et al., 2015). Following a deliberate practice approach (Dunn & Shriner, 1999) these interactions and discussions with colleagues and principals can be regarded as learning opportunities for teachers that are relevant to affect performance (Ericsson, Krampe, & Tesch-Römer, 1993). Finally, Goddard et al. (2000) delineate that collective efficacy form group norms that may instigate positive interactions predicting instructional quality.

To conclude, a context effect can be defined in terms of equally motivated teachers reporting more or less instructional quality in a more or less efficacious school, a school with more or less collaboration, or a school with more or less instructional leadership. These multilevel considerations are, however, not consistently reflected in empirical research designs when investigating instructional quality.

1.3 Cross-Level Interactions of the School Environment in the Relationship Between Self-Efficacy and Instructional Quality

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While instructional quality may be predicted by school characteristics over and above individual teacher self-efficacy (context effect), the question also arises whether the relationship between teacher self-efficacy and self-reported instructional quality is independent from the context in which teachers are in. Holzberger et al. (2014), for example, found that high self-efficacy elicited a positive teacher-student relationship (as an indicator of instructional quality) only when teachers perceived their school environment to be supportive with respect to basic psychological needs. As such, school environment variables may affect the efficiency of the individual teacher's self-efficacy (a cross-level interaction effect).

Theories in the fields of work and organizational psychology (e.g., Cable & DeRue, 2002; Latham & Pinder, 2005) point to the relevance of the interaction between personal and environmental characteristics that can be decisive for outcome behavior. The relationship between personal characteristics and outcome behavior may vary depending on environmental characteristics. Transferring this idea to the school context, teachers' self-efficacy may only, or more efficiently, translate into high instructional quality when the school environment exhibits certain characteristics. For example, low-efficacy teachers may need a supportive environment (e.g., highly collaborative or highly efficacious colleagues, high instructional leadership) in order to provide good instructional quality, whereas teachers with high self-efficacy beliefs would be not as dependent on the level of collaboration or collective efficacy of their colleagues. This effect is described as a need-supplies effect in the person-environment-fit literature, in which an organization fulfills the needs of an individual (cf. Cable & DeRue, 2002). On the contrary, leaning on reflections on strong and weak situations (e.g., Meyer & Dalal, 2009), a teacher's self-efficacy might translate more efficiently into instructional quality at schools that offer more opportunities to participate (a weak situation, allowing for interindividual differences) whereas teachers' instructional quality might be less relevant in schools that offer less opportunities to participate (strong

situation). Thus, in the present study we will analyze whether school characteristics moderate the relationship between teacher self-efficacy and self-reported instructional quality.

2. The Present Study

Given that research to date on teachers' self-efficacy and instructional quality has hardly addressed the school level, in the present study we extend research on teacher self-efficacy and instructional quality by adopting a multilevel approach. Therewith, the present study aims to investigate whether, in addition to teacher level relationships, (1) bivariate relationships can also be established at the school level, where schools with more highly motivated staff might also achieve higher instructional quality (Level 2 associations), (2) self-reported instructional quality can also be directly predicted by school characteristics (context effect) and (3) the relationship changes depending on the characteristics of the school at which a teacher is situated (cross-level interaction). In addition to bivariate associations, we explored the context effects as well as the cross-level interactions in multilevel multiple regression analyses.

Specifically, we ask the following research questions:

1. Is there a relationship between teacher efficacy and self-reported instructional quality both within schools (individual teacher level, Level 1) and between schools (Level 2)?
2. Are school environment characteristics associated with differences in self-reported instructional quality after controlling for teachers' individual efficacy beliefs (context effects)?
3. Can school environmental characteristics moderate the relationship between individual teachers' self-efficacy and their individual level of self-reported instructional quality (cross-level interactions)?

The analytical model is depicted in Figure 1. We included two aspects of self-reported instructional quality: one indicator for cognitive activation and one indicator for classroom

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management. As self-efficacy is considered to be domain-specific, we selected teachers' self-efficacy in instruction as well as in classroom management because we were mostly interested in the congruent associations of efficacy beliefs in instructions on cognitive activation and the congruent relationships of efficacy beliefs in classroom management and classroom management.

Figure 1. A hypothesized multilevel model of school-level (Level 2) and individual teacher-level (Level 1) associations between teacher self-efficacy, perceived school characteristics, and self-reported instructional quality. Arrows crossing the levels designate context effects and cross-level interactions. RQ = Research Question.

3. Methods

3.1 Sample

For this study, we re-analyzed data from the OECD Teaching and Learning International Survey 2018 (TALIS 2018; OECD, 2019). Forty-eight countries participated in TALIS 2018 across all ISCED levels. The present analyses are based on country-level data from Austria. Austria participated at the ISCED level 2. In the Austrian sample, 4,255 teachers from 246 participating schools answered a questionnaire. Most of the schools were

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located in large cities ($n = 58$) and villages and smaller cities ($n = 41$), and fewer in small towns and towns ($n = 14$; $n = 78$ location not stated). On average each school had a total staff of 22.5 teachers ($SD = 13.2$), of which 17 teachers ($SD = 4.3$) per school participated. Teachers had, on average, 19.8 years of teacher experience ($SD = 13.06$), with 69.5% of them being female.

3.2 Instruments

In TALIS, variables were assessed via questionnaire. Item wordings, reliability scores, and results from confirmatory analyses and invariance testing for the international data can be retrieved in the TALIS 2018 Technical Report (OECD 2019). The calculated reliabilities of our sample are presented in Table 1.^[1] The multilevel McDonald's omega (Geldhof et al., 2014) and Cronbach's alpha coefficients indicated acceptable reliability for almost all study variables (with the exception of cognitive activation). Negative items were reverse-coded so that higher values indicated higher characteristics.

3.2.1 Self-Efficacy and Collective Efficacy. Two self-efficacy subscales were included, self-efficacy in classroom management (e.g., “[can] control disruptive behavior in class”) and self-efficacy in instruction (e.g., “[can] provide an alternative explanation, for example when students are confused”), measured with four items each. Teachers indicated their responses on a 4-point scale (1 = “Not at all” to 4 = “A lot”). In order to assess collective motivation as school-level variables, we computed school-mean aggregates of teacher ratings per school.

3.2.2 Instructional Quality. Teachers rated instructional quality on two subscales, with four items each and a four-point response format (1 = Never or almost never to 4 = Always). One subscale refers to cognitive activation (e.g., “I present tasks for which there is

no obvious solution”) and one subscale describes disciplinary climate as an indicator for classroom management (e.g., “I tell students to follow classroom rules.”).

3.2.3 School Characteristics. With respect to school characteristics, teachers rated the frequency of collaboration activities on a six-point response format (1 = Never to 6 = Once a week or more“) with four items (e.g., “Exchange or develop teaching materials with colleagues”). Principals rated the level of participation at school (three items; e.g., “This school provides staff with opportunities to actively participate in school decisions”) and their instructional leadership behavior (three items; e.g., “I collaborated with teachers to solve classroom discipline problems”) on a four-point response scale (1 = Never or rarely to 4 = Very often).

3.3 Data Analysis

Data management was performed in R (R core Team, 2020). Multilevel correlations and regression analyses were computed in Mplus (Version 8, Muthén & Muthén, 2017) with listwise deletion for missing values. To account for the complex sampling design implemented in TALIS we included the teacher and school level weights provided in the TALIS data as recommended for multilevel analyses (e.g., Pfeffermann et al., 1998; Rabe-Hesketh & Skrondal, 2006) and implemented in Mplus (Asparouhov, 2006). To investigate associations of self-reported instructional quality with teacher self-efficacy, both on the individual teacher level (Level 1) and between-school level (Level 2; Research Question 1), we computed two random-intercept models for each of the instructional quality facets^[2]. Teacher efficacy beliefs (in instruction and in classroom management) were added as predictor variables on both levels. To clearly separate individual teacher associations from between-school associations, we grand-mean-centered school-mean aggregates as predictors on the between-school level and school-mean-centered predictors on the individual teacher level (Hamaker & Muthén, 2020). For Research Question 2, we centered Level 1 predictors

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at the grand mean and added the school aggregate as a Level 2 predictor to model the unique context effect of the teacher efficacy aggregate (Hamaker & Muthén, 2020). For example, the unique context effect of collective efficacy can be interpreted as the expected difference in self-reported instructional quality when comparing two schools differing in one unit of collective efficacy while controlling for their individual teachers' self-efficacy. Stated simply, the context effect describes the effect of being the same teacher at a more or less efficacious school (cf. Raudenbush & Bryk, 2002). As measures of effect size we report standardized model results and R square provided by Mplus for random intercept models. To investigate the cross-level interactions (Research Question 3), we first estimated two random slope models (one for cognitive activation and one for classroom management) with grand-mean-centered collective efficacy and school-mean-centered teacher efficacy on the school and individual teacher level respectively. Next, we separately included our school environment variables (grand-mean-centered) as predictor variables of random intercepts and random slopes (cross-level interactions; Heisig & Schaeffer, 2019). The code for the analyses was run in Mplus and R; additional results are provided at the OSF (https://osf.io/v639m/?view_only=d96bb43840f3409e9cc66d379309e837).

4. Results

4.1 Preliminary Analyses

The descriptive statistics, reliabilities, intraclass correlations (ICCs), bivariate correlations and sample sizes (Level 1 and Level 2) of the study variables are summarized in Table 1. The ICCs (Hox et al., 2018) revealed that teacher efficacy and self-reported instructional quality could be attributed mainly to within-school differences (i.e., individual teacher level). In these ratings, only 1% to 5% of variance reflected between-school differences. In contrast, the teacher-rated level of collaboration reflected both between-school (17%) and teacher-level differences.

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Table 1

Univariate higher-order moment descriptive statistics, reliabilities, intra-class correlations, and bivariate correlations of the study variable

	1	2	3	4	5	6	7	ω
Teacher motivation								
1) Efficacy belief in instruction		.50	.76*	.51*	.31	-.14	-.12	.93
2) Efficacy belief in classroom management	.45*		.32	.89*	.48*	-.10	-.34*	.95
Self-reported instructional quality								
3) Cognitive activation	.31*	.15*		.54*	.05	-.05	-.13	.77
4) Classroom management	.13*	.29*	.05*		.35*	-.15	-.23	.97
External school characteristics								
5) Collaboration (teacher-rated)	.26*	.17*	.15*	.09*		-.06	.04	.92
								α
6) Participation (principal-rated)	—	—	—	—	—		.17	.63
7) Leadership (principal-rated)	—	—	—	—	—	—		.71
<i>N Level1</i>	4149	4150	3601	3595	4155			
<i>M^a</i>	3.11	3.25	2.21	2.85	4.62	3.21	3.05	
<i>Var</i>	0.28	0.25	0.22	0.51	1.09	0.32	0.39	
ω	.72	.80	.57	.84	.75	—	—	
<i>ICC</i>	.01	.03	.03	.05	.17	—	—	

Note. Level 1 (teacher level) correlations are presented below the diagonal; Level 2 (school level) correlations are presented above the diagonal. N(Level 2) = 246 (for teacher ratings)/164 for merged principal ratings. Efficacy beliefs are self-efficacy on the individual level, collective efficacy on the school level. ^a response scales from 1–4, with the exception of collaboration (1–6).

* $p < .05$.

4.2 Is There a Relationship Between Teacher Motivation and Self-Reported Instructional Quality Both Within Schools as Well as Between Schools?

The zero-order correlations on the individual teacher level (within-schools; Table 1, below the diagonal) revealed significant small to moderate positive bivariate associations of teacher self-efficacy and the two self-reported indicators of instructional quality. On the school level (Table 1, above the diagonal), these associations were significant and strong, with the exception of the association between collective efficacy in classroom management and cognitive activation, which was only moderate and nonsignificant.

In random intercept models, we included both facets of teacher self-efficacy in one model to investigate their unique effects on instructional quality (see Table 2). In line with the zero-order correlations, the random intercept models revealed significant positive associations between teacher efficacy and instructional quality on both analytical levels. More specifically, uniquely significant parameters indicated that schools with higher collective efficacy concerning instruction were also the schools where teachers reported higher cognitive activation (Level 2), and teachers who reported higher self-efficacy concerning instructions also reported higher cognitive activation than teachers reporting lower levels of self-efficacy (Level 1). Moreover, schools with higher collective efficacy concerning classroom management were also the schools where teachers reported better classroom management (Level 2), and teachers who reported higher self-efficacy concerning classroom management also reported better classroom management than teachers reporting lower levels of self-efficacy (Level 1).

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Table 2

Fixed and random effects resulting from the random intercept models of self-reported instructional quality (cognitive activation, classroom management) predicted by teacher efficacy beliefs.

	Cognitive activation		Classroom Management	
	<i>B (SE)</i>	β	<i>B (SE)</i>	β
Intercept	2.22 (0.01)*		2.84 (0.01)*	
Level 1				
Self-efficacy in instruction	0.28 (0.02)*	.30	−0.01 (0.02)	−.01
Self-efficacy in classroom management	0.00 (0.02)	.00	0.30 (0.02)*	.28
Level 2				
Self-efficacy in instruction	0.38 (0.09)*	.66	0.01 (0.09)	.01
Self-efficacy in classroom management	0.05 (0.07)	.08	0.67 (0.08) *	.78
	<i>Var</i>	<i>R2</i>	<i>Var</i>	<i>R2</i>
Level 1 (Residual)	0.19	.09	0.23	.08
Level 2 (Intercept)	0.00	.49	0.01	.61

Note. * $p < .05$.

4.3 Are School Variables Associated With Differences in Self-Reported Instructional Quality After Controlling for Teachers' Individual Motivation Levels (Unique Context Effect)?

With respect to cognitive activation, our analyses investigating context effects revealed that being a teacher (with an individual efficacy level) at a more or less efficacious school (collective efficacy) did not make a significant difference (collective efficacy in instruction: $b(SE) = 0.11(.09)$, $\beta = .25$, $p = .26$; collective efficacy in classroom management: $b(SE) = 0.04(.07)$, $\beta = .08$, $p = .61$). Additionally, more-external school characteristics were not significantly associated with teachers' self-reported cognitive activation when controlling for teachers' self-efficacy (collaboration: $b(SE) = -0.00(.02)$, $\beta = -.03$, $p = .85$; participation: $b(SE) = -0.00(.02)$, $\beta = -.01$, $p = .97$; principal leadership: $b(SE) = -.01(.02)$, $\beta = -.07$, $p = .71$).

With regard to classroom management, there was a specific positive association with unique collective efficacy in classroom management (collective efficacy in instruction: $b(SE) = 0.01(.09)$, $\beta = .02$, $p = .87$; efficacy in classroom management: $b(SE) = 0.37(.09)$, $\beta = .57$, $p < .001$). Thus, being a teacher among other teachers with an average high collective efficacy in classroom management was associated with higher self-reported classroom management than being the same teacher at a less efficacious school. Additionally, more-external school characteristics were not significantly associated with teachers' self-reported classroom management when controlling for teachers' self-efficacy (collaboration: $b(SE) = 0.02(.02)$, $\beta = -.11$, $p = .33$; participation: $b(SE) = -.03(.02)$, $\beta = -.13$, $p = .28$; principal leadership: $b(SE) = -0.02(.02)$, $\beta = -.09$, $p = .42$).

4.4 Is Perceived School Environment Associated With Differences in the Relationship Between Teacher Motivation and Teachers' Self-Reported Instructional Quality (Cross-level Interactions)?

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To investigate whether the relationships between teacher self-efficacy and self-reported instructional quality (slopes) differed across schools, we first estimated random slope models, which revealed only small non-significant differences between schools in (Level 1) associations between teacher self-efficacy and self-reported instructional quality ($p = .112$ [classroom management predicted by self-efficacy in instructions] to $.674$ [classroom management predicted by self-efficacy in classroom management])^[3].

In a second step, we investigated whether perceived school characteristics would be relevant moderator variables for the small between-school differences in teacher-level associations between teacher efficacy beliefs and self-reported instructional quality. We therefore added school characteristics as Level 2 predictors for random intercepts and random slopes (cross-level interactions; Table 3)^[4]. With the exception of teachers' collective efficacy beliefs, none of the main effects of external school characteristics were significantly associated with school-level instructional quality (random intercepts).

With regard to cross-level interactions, the analyses revealed that only 4 out of the 16 investigated cross-level interactions approached the significance level. Given that we were mostly interested in congruent associations—self-efficacy in instruction with cognitive activation and self-efficacy in classroom management with self-reported classroom management—3 out of 8 relevant interactions approached the significance level. Whereas none of the cross-level interactions predicting cognitive activation significantly differed from zero, there were 4 (marginally) significant cross-level interactions predicting classroom management.

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Table 3

Main and cross-level effects of school characteristics (Level 2 moderator) as predictor variables for intercepts and slopes of Level 1 associations among self-efficacy and instructional quality.

Moderator	Cognitive activation	Classroom Management
	<i>B (SE)</i>	<i>B (SE)</i>
Collective efficacy		
collective efficacy in instructions	0.38 (0.09)*	0.02 (0.09)
collective efficacy in classroom management	0.04 (0.07)	0.67 (0.08)*
cross level interaction		
x self-efficacy in instruction a	0.19 (0.13)	−0.09 (0.13)
x self-efficacy in classroom management ^a	0.08 (0.15)	−0.30 (0.12)*
Collaboration (teacher-rated)		
main effect	0.00 (0.02)	0.02 (0.02)
cross level interaction		
x self-efficacy in instruction	0.03 (0.04)	0.04 (0.05)
x self-efficacy in classroom management	−0.03 (0.04)	−0.09 (0.04)*
Participation (principal-rated)		
main effect	−0.01 (0.02)	−0.04 (0.02)
cross level interaction		
x self-efficacy in instruction	−0.01 (0.04)	−0.12 (0.05)*
x self-efficacy in classroom management	−0.00 (0.05)	0.08 (0.04) ⁺
Leadership (principal-rated)		
main effect	−0.01 (0.02)	−0.02 (0.02)
cross level interaction		
x self-efficacy in instruction	−0.02 (0.03)	0.02 (0.04)
x self-efficacy in classroom management	−0.04 (0.04)	0.00 (0.05)

Note. ^aSelf-efficacy facets interact with their respective Level 1 predictor variable, i.e. instructions with instructions and classroom management with classroom management. * $p < .05$, ⁺ $p = .051$.

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The significant and marginally significant cross-level interactions are displayed in Figure 2. The first column depicts relationships between the teacher-level associations and the school-level moderator and the second column simple slopes for high [+1 SD] vs. low [-1 SD] values of the level 2 moderator. The cross-level interactions mean that in schools with a higher collective efficacious staff, the associations between teachers' individual self-efficacy in classroom management and their self-reported classroom management were smaller than in schools with low collective efficacy (Figure 2.A). This can also be seen when plotting two separate regression lines for high vs. low levels of collective efficacy, that also include the simple intercepts predicted by differences in collective self-efficacy (Figure 2.B). Likewise, although the interactive coefficient is not as large as for collective efficacy, at schools with a higher degree of teacher collaboration (Figure 2.C/D), smaller relationships between individual self-efficacy and classroom management are found.

With regard to principals' participation ratings, the more participation the principal reported, the larger was the relationship between self-efficacy in classroom management and classroom management (Figure 2.E/F). One cross-level interaction that we did not expect in the first place indicated that at schools with a higher participation the association between teachers' self-efficacy in instruction and self-reported classroom management was smaller compared to schools with a lower degree of participation (Figure 2.G/H).

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Figure 2. Significant cross-level interactions. Left column: Estimated coefficients of self-reported classroom management for teacher self-efficacy (classroom management [A, C, E] and instructions [G]) depending on school characteristics. Right column: Predicted values for

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self-reported classroom management predicted by teacher self-efficacy (classroom management [B, D, F] and instructions [H]) at 1 SD Above (high, solid) and 1 SD Below (low, dashed) the Means of the School Characteristics of collective efficacy in classroom management. School characteristic: collective efficacy on classroom management (A and B), collaboration (C and D), participation (E, F, G, H). Bold lines indicate the estimated coefficients/predicted values, light lines the respective 95% confidence interval (CI).

5. Discussion

The present study extended previous research by investigating self-efficacy and instructional quality from a multilevel perspective, with a specific emphasis on the importance of school characteristics. We included self-reported cognitive activation and classroom management as indicators for instructional quality and the equivalent self-efficacy beliefs (self-efficacy in instruction and in classroom management) as predictor variables. As school characteristics, we aimed at collective efficacy, teacher collaboration, school participation, and principal leadership. With our focus on the school level and the interaction between self-efficacy and school characteristics, we sought to find out more about the role of the school environment in which teachers are situated and thereby contribute to the discussion on contextual features in teacher motivation (Woolfolk Hoy, 2008) and instructional quality (Gitomer & Bell, 2013).

5.1 Positive Relationships between Collective Efficacy and Self-Reported Instructional Quality at the School Level

With our first research question, we extended previous research by applying a multilevel perspective and by investigating whether the positive relationship between self-efficacy and self-reported instructional quality can be also established at the organizational level (Chen & Kanfer, 2006). At the teacher level, the positive relationships between self-

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efficacy and self-reported instructional quality confirmed previous research. At the school level, our analyses revealed even stronger relationships than at the teacher level. Even though the results seem promising, they should be treated with caution given the small nesting effects for teacher self-efficacy and self-reported cognitive activation and classroom management.

Although previous research on teacher self-efficacy has also applied multilevel relationships, the analyses were mainly restricted to the student and the teacher level (e.g., Lazarides et al., 2020). Indeed, interactions between students and teachers are a crucial determinant for teachers' instructional quality (Doyle, 2014; Woolfolk Hoy, 2008). Nevertheless, in order to understand schools from an organizational perspective, the present study constitutes a first step in the analyses of team-level motivation processes at school (Chen & Kanfer, 2006). Although positive associations between efficacy and self-reported instructional quality were found at the school level, future research should include further (more collective) work performance outcomes in the school context (e.g., school climate, team teaching), to understand team-level motivation processes (Chen & Kanfer, 2006; Harris & Rutledge, 2010).

5.2 Context Effects: Cognitive Activation Independent from the School Context, Classroom Management Stimulated by Collective Efficacy

With our second research question that addresses context effects, we aimed to investigate sources of self-reported instructional quality at the school level over and above individual teacher self-efficacy. So far, research has only rarely addressed institutional sources of instructional quality. Hill et al. (2015) selected “test preparation activities,” “testing has changed instruction,” “school resources,” and “district” as potential institutional resources for instructional quality (measured with multiple indicators).

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Our findings here only partly support our assumption that school characteristics predict self-reported instructional quality. No significant context effects (i.e., collective efficacy, collaboration, participation, leadership) were found for cognitive activation. Thus, cognitive activation seems to be rather independent from the school context. However, being a teacher at a highly efficacious school (with regard to classroom management) was associated with higher self-reported classroom management at the teacher level compared with being an equally efficacious teacher at a less efficacious school. Future research should illuminate possible underlying mechanisms. It is possible that collective efficacy is confounded by socioeconomic composition at school (e.g., Rjosk et al., 2014) or school climate (e.g., Berkowitz et al., 2017) that may also affect a teacher's teaching.

5.3 Interaction Between Teacher Motivation and School Characteristics

Finally, we modeled the interaction between teachers' self-efficacy and school characteristics. We investigated whether the school environment moderated the associations between teacher-level motivation and self-reported instructional quality (cross-level interactions). In the present study, we adopted need-supply considerations in which low-efficacy teachers may need a supportive environment in order to provide good instructional quality. Hence, the gap in self-reported instructional quality between more or less self-efficacious teachers should be lower in highly supportive environments, whereas in less supportive environments instructional quality should depend more on the individual teacher's self-efficacy. With respect to self-reported classroom management, this assumption was partially supported in that our analyses revealed stronger positive relationships with self-efficacy in classroom management when the staff had low collective efficacy and when there was less teacher collaboration. In contrast, another significant cross-level interaction indicated that positive relationships between self-efficacy in classroom management and self-reported classroom management were stronger when teachers had more of an opportunity to

participate in school decisions. This is in line with our assumption that schools that offer a higher degree of participation also offer the platform for interpersonal differences to unfold (cf. Meyer & Dalal, 2009). Beyond this, our analyses revealed that the relationship between self-efficacy and self-reported cognitive activation did not vary across the investigated school characteristics. Nevertheless, the results should be interpreted with caution given the small magnitude of between-school variance in associations between teacher-level self-efficacy and self-reported instructional quality (no significant random slopes; see Mathieu et al. (2012) for the power to detect cross-level interaction effects).

5.4 Limitations and Future Research Directions

In the present study, we took advantage of the rich TALIS 2018 data set, in which multiple teachers per school participated, data that would be very expensive to collect otherwise. The TALIS design has the exceptional advantage to model variance at the teacher and school levels. The random sampling strategy in TALIS argues for the representativeness of our findings and their generalizability at least for the educational system in Austria, the country in which we performed our analyses. Nevertheless, with this secondary data analysis we were bound to the operationalizations and the design in TALIS. In particular, we discuss the use of teacher ratings of instructional quality, the measure of collective efficacy, and the cross-sectional data for the interpretation of the findings.

First, while in the present study, principals rated their instructional leadership and participation at schools, we used teacher ratings for both self-efficacy and instructional quality, as well as the collaboration level at school. Assessment of instructional quality has been intensely debated, with low intercorrelations found across the three rater groups (teacher, students, external observers; see Kunter and Baumert (2006), Wagner et al. (2015)). Both student as well as teacher ratings of instructional quality have been criticized as being biased or undifferentiated (den Brok et al., 2006). However, with regard to classroom

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management, Kunter and Baumert (2006) found substantial agreement between teachers and students. On the other hand, interrater differences were found for cognitive activation. While teacher ratings of instructional quality may be distorted, the key aim of the present study was to decompose variance on the teacher and school levels instead of evaluating the absolute level of cognitive activation and classroom management. Wenger et al. (2018) analyzed student ratings of instructional quality based on PISA data and found slightly higher intraclass coefficients for the two subscales of instructional quality than the ones we found for the teacher ratings. Thus, it is reasonable to assume that student and teacher ratings of instruction operate similarly on the school level. Nevertheless, due to perspective differences as well as to avoid a common methods bias, future research should not focus exclusively on teacher self-reports.

Second, in the present study we used teacher self-efficacy as a predictor variable for self-reported instructional quality and its interaction with the school context and we used the school-level aggregated scores of teachers' self-efficacy as a measure of collective efficacy. While Bandura suggested this way of measurement, Goddard et al. (2000) developed a scale in which individual teachers rated the collective capability (e.g., "Teachers in this school are able to get through to difficult students" (Goddard et al., 2000, p. 492)) of the school council. As such, in both cases, beliefs are rated by the individual teachers, and multilevel approaches take into account that teachers from the same school may have differing perceptions. However, using the same ratings for self-efficacy and collective efficacy prohibits analysis of mutual dependencies (e.g., collective efficacy may affect individual self-efficacy and vice versa (Chen & Kanfer, 2006)). Although our approach to assessing teacher motivation at the school level extends previous research that has almost exclusively examined motivation from an individual perspective, future research should not only model aggregated individual motivation at the school level, but also include ratings on collective motivation.

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Finally, the cross-sectional design of the study only allowed us to analyze a snapshot of how teachers perceive both their self-efficacy, school environments, and instructional quality. Of course, these variables interact with each other, and ratings are not independent. Leaning on social group-dynamics theory (e.g., social learning theory (Bandura, 1977)), it can be assumed that teachers collaborating at the same school might adapt their efficacy beliefs toward a common school level. The cross-sectional data also kept us from exploring the processes of how teachers might have adapted to their school environment over time or whether we captured a representative slice among potentially time-varying assessments (e.g., Geiser et al., 2015). Moreover, it is not possible to deduce causality from cross-sectional data. We theoretically derived that teachers' self-efficacy and school characteristics were predictors of instructional quality. However, it is also conceivable that perceived instructional quality reflects back on teachers' self-efficacy (Holzberger et al., 2013) and their perception of the school environment (e.g., Baumeister et al., 1998), or that both processes are at play in recursive feedback loops. Thus, future research should address these processes in longitudinal designs.

5.4 Significance of Findings and Conclusion

The present study extends prior research by addressing the role of the school context in the relationship between self-efficacy and self-reported instructional quality. First, it highlights the importance of modeling teacher self-efficacy not only as a teacher variable, but also on the school level. Our findings showed that in schools with higher collective efficacy, teachers also reported higher instructional quality. As a cautionary note, however, we found that schools only slightly differ in teachers' self-efficacy. Second, our analyses emphasize differences in cognitive activation and classroom management with regard to their dependency on the school context. In the present study, self-reported cognitive activation seems to be rather independent from school context characteristics, but was predicted only by

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teacher self-efficacy. On the other hand, with regard to self-reported classroom management, it makes a difference whether teachers teach in high vs. low efficacious schools. Third, our results show that the relationship between teacher self-efficacy and self-reported instructional quality is not independent of school characteristics. Rather, teacher self-efficacy seems to be more relevant to instructional quality if collective efficacy as well as teacher collaboration are low, and teachers have the opportunity to participate in school decisions. These findings are in line with need-supply and situational strength considerations. Although the effects are rather small and not consistent across all indicators of teacher self-efficacy and self-reported instructional quality, the study constitutes a first attempt at illuminating teacher-school processes in the field of teacher motivation and instructional quality.

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ENDNOTES

^[1] Multilevel confirmatory factor analyses were run in Mplus (Version 8; Muthén & Muthén, (2017) to ensure that the selected items fit the latent dimension. The measurement models largely were supported by the results from the CFAs (Table A1 and Table A2 in the OSF). We thus adhered to the TALIS project's suggested scale assignment when computing manifest scale scores for our main analysis.

^[2] Results of supplementary analyses including only one indicator of efficacy beliefs at a time, can be retrieved from the OSF (Table A3 – A7).

^[3] The fixed, random effects, and Likelihood ratio test statistics resulting from the random slope models can be retrieved from the OSF.

^[4] For reasons of clarity, we summarized only the effects of school characteristics in association with random intercepts (main effects) and cross-level interactions, whereas Level 1 parameters of teacher motivation and Level 2 parameters of teacher motivation are not depicted. Complete model results can be found on the OSF.