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## EDITED BY

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## REVIEWED BY

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J. E. Purkyne University, Czechia

## \*CORRESPONDENCE

Gerald M. Weiher  
✉ [weiher@psych.uni-frankfurt.de](mailto:weiher@psych.uni-frankfurt.de)

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# When work bothers your mind: a diary study on the relationship of German teachers' work-related rumination with fatigue

Gerald M. Weiher\*, Yasemin Z. Varol and Holger Horz

Department of Educational Psychology, Institute of Psychology, Goethe University Frankfurt, Frankfurt, Germany

This study investigated the association of school attendance restrictions in the early stages of the coronavirus disease pandemic with teacher-specific workload, and work-related rumination of teachers in Germany. Deduced from the effort-recovery model, that assumes that work might lead to strain reactions, making recovery necessary to avoid long-term health impairments, fatigue and positive as well as negative contents of work-related rumination in nonwork time were investigated in a five-day diary study with three measurement points per day. A total of 1,697 daily measures of 174 teachers were gathered over three consecutive workdays and the weekend. Only those days were included in which the teachers worked. Multilevel structural equation modeling revealed that teachers during school restrictions showed lower teacher-specific workload, which was associated with lower levels of affective rumination and problem-solving pondering. The effect on fatigue was mediated only by affective rumination such that a higher affective rumination was related to a higher fatigue level on the between and within-level. There was a significant three-path mediation from group belongingness over teacher-specific workload to affective rumination and fatigue. Problem-solving pondering did not affect fatigue level. The present study provides evidence of the association of COVID-19 restrictions with teacher-specific workload and the importance of differentiating the facets of work-related rumination.

## KEYWORDS

teachers, work-related rumination, fatigue, diary study, COVID-19

## 1. Introduction

Many occupational groups were affected by work-related restrictions due to the COVID-19 pandemic, not being able to work at their usual workplace and working time. One of them are teachers, as they continued distance teaching despite the schools were closed (Mahmood et al., 2021; Pöysä et al., 2021). Studies show that the pandemic and accompanying political orders were related to and impact emotional reactions, stress, negative affect, and life satisfaction (Zacher and Rudolph, 2020; Bellingtier et al., 2021; Kumar et al., 2021). However, the examination of the effects of changed work situations in times of social distancing on recovery and work-related stress above for example boundary management styles (Allen et al., 2021) still needs to be established (Rudolph et al., 2021). As shown in meta-analysis, recovery experiences are essential for well-being and stress experience (Headrick et al., 2019; Steed et al., 2021). In recent times, differences in occupations in recovery experiences (Headrick et al., 2019) and in

the context of COVID-19 have been stressed upon (Rudolph et al., 2021).

To focus research on teachers' health, psychological well-being, and recovery is necessary for several reasons. Teachers are central protagonist in every educational system and their performance is crucial to the health and achievement of students (Viac and Fraser, 2020). Impaired psychological health of teachers is shown to be related to lower well-being and achievement of students, lower perceived performance of teachers and higher rates of turnover intentions of teachers (Madigan and Kim, 2021a,b; Klusmann et al., 2022; Maricuțoiu et al., 2023). As the COVID-19 related school restrictions might have influenced teachers' psychological well-being and health, it becomes apparent to focus on that influence in detail. School restrictions and the necessity to work at home could have increased the difficulties of managing the work and nonwork boundaries for recovery, which is considered a challenge for teachers anyway (Türktozun et al., 2020). Conversely, it can be argued that school restrictions and the changed teaching conditions are associated with lower strain due to teacher-specific job demands. This is because the amount of daily hassles such as the direct confrontation with students' misbehaviour or parents' expectations (Montgomery and Rupp, 2005; Beltman et al., 2011) might be reduced.

The present diary study was conducted in the earliest stages of the pandemic outbreak in Germany in the year 2020. It contributes to the literature in three ways: first, the study examines short-term associations of a changed work condition because of COVID-19 related school restrictions with work-related stress and recovery experience of teachers (cf. Rudolph et al., 2021). The following study, focuses on the experience of teacher-specific job demands as stressful, which can be summarized as workload (cf. van Dick and Wagner, 2001), and its relationship to school restrictions in the first weeks of the lockdown. In doing so, the study follows the call to extend research above the health care sector and account for differences between occupations in times of COVID-19 (Rudolph et al., 2021). Even though the pandemic outbreak affected the data collection, the study was originally planned to investigate the effect of daily teacher-specific workload on work-related rumination and well-being. Therefore, second, the study contributes to recovery research, as originally planned. It focuses on work-related ruminative thoughts of teachers in nonwork time, which is a crucial component in recovery research and is associated with differential effects on individual well-being considering different content and valence of the work-related ruminative thoughts (Headrick et al., 2019; Jimenez et al., 2021; Wendsche et al., 2021; Weigelt et al., 2023). Especially in teachers difficulties in mentally distancing from work and negative connoted work-related thoughts has been shown to be related to well-being impairments (Varol et al., 2021; Weiher et al., 2022). The effect of daily work-related rumination in leisure time on fatigue in the next morning as an indicator of (un-) successful recovery and individual well-being (Meijman and Mulder, 1998; Sonnentag, 2018) is investigated. Work-related thoughts in nonwork time are shown to be a mediator between job demands and stress experience (Sonnentag and Fritz, 2015). The abrupt restrictions provided the opportunity to investigate the association between changed work situation and teacher-specific workload in the first weeks of the lockdown. The study, therefore, considers different work situations and its further effects on recovery experience. This is significant, since occupation-specific demands have rarely been taken into account when studying

work-related thoughts in nonwork time, especially in the teaching profession (Türktozun et al., 2020). Furthermore, the study follows the call (cf. Headrick et al., 2019) to not only consider the negative (e.g., affective rumination), but also more neutral connoted forms of work-related thoughts in nonwork time in taking problem-solving pondering into consideration (Querstret and Cropley, 2012) that might also have beneficial effects on well-being. Third, the present diary study contributes to the literature by integrating a daily perspective on fatigue level. This elaborates on occupational health research in times of pandemics, which is mostly cross-sectional in nature (Rudolph et al., 2021) and add to the few daily diary studies, which has been conducted during the pandemic (Chong et al., 2020). In separating between- from within-person effects, the present study examines the effect of school restrictions and accompanying workload differences on average fatigue in the morning. Furthermore, daily fatigue level with respect to daily workload and work-related rumination is examined. The results should facilitate practical implications such as the development of interventions aimed to foster well-being in teachers above the time of the COVID-19 pandemic.

## 1.1. The work situation of German teachers in times of COVID-19

From March, 16, 2020 school attendance were restricted nationwide for primary and secondary schools (Steinmetz et al., 2020). Besides final examinations of secondary schools, compulsory school attendance for students was suspended and promotion to the next class was guaranteed. Work for teachers remained compulsory. They ensured children care from system-relevant occupation employees (e.g., health care). Teachers were not under any financial risk and did not have to fear heightened job insecurity. There is some evidence about the teachers' work in this early time in Germany (Huber and Helm, 2020). Typical work requirements, such as the preparation of teaching materials, correction of examinations or student contact, only occurred to a limited extent for distance teaching, as the overall concept for the provision and assessment of learning opportunities still had to be worked out at many schools (Eickelmann and Drossel, 2020). During the first few weeks of the restrictions, lower levels of direct interaction (e.g., video-based teaching) took place (Huber and Helm, 2020). Additionally, the risk and fear of being exposed to the virus has to be considered as well (cf. Chen et al., 2022), since it might have led to the perception of elevated levels of threats to ones' own health while working in class (cf. Sinclair et al., 2021). Teachers in class can be classified as the group with medium risk exposure level as defined by the World Health Organization (2020), because social distancing in work situation (while teaching) was not always possible (cf. Sinclair et al., 2021). Hence, school restrictions and thus, no or reduced attendance in class might imply less risk exposure due to teachers' job demands (e.g., students in class) for teachers during compared to teachers before school restrictions. Overall, it is feasible to suggest that lower teacher-specific workload was experienced during the first weeks of the school restrictions (vs. months cf. Pöysä et al., 2021). That said, we are aware of differential picture of demands and strain level of teachers during the time of COVID-19. For example Klusmann et al. (2023) reported cross-sectional data from October 2020 in which 56.4% of the teachers reported an increase in emotional exhaustion during COVID-19 and

43.3% no change. Bleck and Lipowsky (2022) could not report an association between the COVID-19 pandemic and exhaustion when asking German teachers in summer 2020. As the political orders and demands concerning the work of teachers changed frequently during the time, it is, therefore, necessary to examine the exact time of the studies being conducted. There are three studies to our knowledge that focused on teachers' well-being roughly in that time the present study was conducted. Huber and Helm (2020) surveyed a representative sample of German, Austrian, and Swiss school staff members (86% teachers) at the end of March to beginning of April 2020. They found that 39% agreed or partly agreed, 23% (partly) disagreed and 39% were undecided to the sentence that they would be highly burdened of the situation. Eickelmann and Drossel (2020) found in a representative sample of German teachers in April 2020 that 33.9% of the teachers experienced higher burden due to the new situation. However, 28.1% did not see any difference and 36.2% of the teachers experienced less burden. The cross-sectional nature of the two studies makes it difficult to draw conclusions to the daily experience and the comparison between the time before and during the COVID-19 situation. However, Hilger et al. (2021) conducted a longitudinal study with teachers with one measurement point in January/February 2020 and the second in May 2020. They found a decrease in resources but also a decrease of demands and fatigue level during this time. Hence, following our aforementioned argumentation and other data from more well educated samples, showing good well-being during the first weeks of the lockdown (Schad and Rabovsky, 2022), it is feasible to postulate the following hypotheses when conducting a diary study:

*Hypothesis 1:* Compared to the teachers before school restrictions, the teachers during school restrictions experienced lower amount of teacher-specific workload in the first weeks of the lockdown.

## 1.2. Work, recovery, and fatigue in times of COVID-19

According to the effort-recovery model (E-RM; Meijman and Mulder, 1998), one of the core theories in recovery research (Headrick et al., 2019; Steed et al., 2021), work is stressful and demands individuals' cognitive, emotional, and physical resources (Meijman and Mulder, 1998). Work may trigger strain reactions leading to higher physiological or negative activation (Steed et al., 2021) and resource mobilization. As soon as the individual is no longer exposed to job demands, the activation level will adjust to the baseline level. However, when individuals are unable to recover because of higher job demands, such as higher workload, or insufficient time for recovery, the baseline level is not reached (Meijman and Mulder, 1998; Steed et al., 2021), and higher fatigue in the morning is likely (cf. Headrick et al., 2019). Fatigue is a crucial factor in occupational health and recovery research and is related to psychological, physical and job impairments (Headrick et al., 2019; Steed et al., 2021). Supporting the suggestions of the E-RM, Bennett et al. (2018) showed in a meta-analysis that higher job demands were related to a higher level of fatigue, mediated by recovery experiences.

As suggested above, job demands of teachers could have been experienced as less stressful during the first weeks of the school restrictions, enabling better preconditions for recovery. As proposed

by the E-RM, this could lead to better recovery outcome (Meijman and Mulder, 1998). Following the E-RM it is further assumed that higher daily workload is associated with higher fatigue level the next morning within the teachers.

*Hypothesis 2:* Compared to the teachers before school restrictions, the teachers during school restrictions have lower average levels of fatigue in the morning (a). This relationship is mediated (b) by teacher-specific workload such that higher stress experience due to job demands are associated with higher levels of fatigue the next morning (between-level). (c) Higher daily teacher-specific workload is associated with higher daily fatigue level the next morning (within-level).

## 1.3. Work-related rumination: relationship with stressors and fatigue

Meta-analytic evidence supports that the effect of job demands on health-related outcomes such as fatigue is mediated by psychological detachment (Bennett et al., 2018), which is confirmed by recent diary study in the teacher sample (Aulén et al., 2022). Psychological detachment is defined as the absence of work-related thoughts in nonwork time (Sonnentag and Fritz, 2015). Teachers have been shown to be especially vulnerable for difficulties in detaching psychologically from work, which is related to higher psychosomatic complaints and higher risk of sickness absence (Varol et al., 2021). In recent times considering the content of work-related rumination in nonwork time has been recommended (Cropley and Zijlstra, 2011; Wendsche and Lohmann-Haislah, 2017; Headrick et al., 2019; Jimenez et al., 2021). Rumination is defined as conscious and recurrent thoughts revolving around a topic in the absence of immediate demands that would require those thoughts (Martin and Tesser, 1996). It is a state that fluctuates within a person; however, it also differs between persons, as there appears to be a trait-like tendency to engage in rumination (Watkins and Nolen-Hoeksema, 2014). Cropley and Zijlstra (2011) introduced the construct "work-related rumination" that refers to rumination on work-related content. Psychological detachment and work-related rumination overlap theoretically. However, research shows that both are distinct factors and that it is important to distinguish the content of work-related thinking (Weigelt et al., 2019, 2023). Cropley and Zijlstra (2011) differentiated two content facets. Affective rumination (AR) is defined as a cognitive state involving the presence of work-related thoughts, which are negative in affective terms, and are likely to be accompanied by negative emotional reactions (Cropley and Zijlstra, 2011). Contrariwise, problem-solving pondering (PSP) is defined as the prolonged thinking about evaluation of previous work to improve it or a particular problem to solve it (Cropley and Zijlstra, 2011). It does not include negative emotional processes and might be joyful or interesting (Cropley and Zijlstra, 2011; Syrek et al., 2017).

In line with the E-RM, job demands can lead to a negative affective response during work (Meijman and Mulder, 1998; Ganster and Rosen, 2013). Sonnentag and Fritz (2015) suggest that higher negative affect might be prolonged in nonwork time and stimulate negative ruminative thoughts about the past work day (Sonnentag and Fritz, 2015; Sonnentag, 2018). This might occur

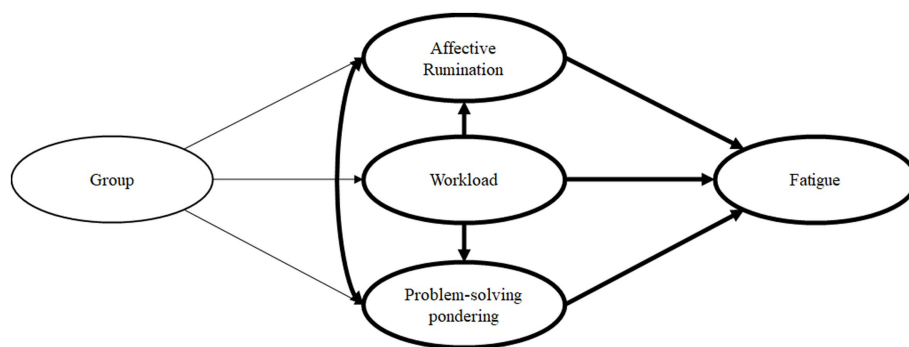


FIGURE 1 Path model including study variables. Bold paths contain study variables on the between and within level.

especially as higher job demands heighten the probability of more unfinished goals that trigger rumination to cognitively converge with goal attainment (Martin and Tesser, 1996; Syrek et al., 2017). Thus, higher AR is expected when a higher amount of job demands or workload are given. Within the E-RM, AR appears to keep the impact of negative activation constant (Cropley and Zijlstra, 2011; Syrek et al., 2017), hindering recovery and leading to higher level of fatigue the next morning (see also Brosschot et al., 2005). Previous evidence supports that AR is related to higher stable stress experience and sleep impairments (Querstret and Cropley, 2012; Hamesch et al., 2014; Syrek et al., 2017; Jimenez et al., 2021). Although PSP might also be triggered by work stress (Hamesch et al., 2014) and unfinished tasks (Syrek et al., 2017), the expected outcome is less clear and meta-analytic evidence only provided small average effect sizes (Jimenez et al., 2021). It might lead to a prolonged exposure to job demands in nonwork time and therefore to negative activation and negative health outcomes (cf. Hamesch et al., 2014). However, if problem solution become reachable, negative affect and activation, which hinder recovery, could be reduced (cf. Martin and Tesser, 1996). Thus, PSP would be expected to lead to lower levels of fatigue the next morning. There is evidence that shows that PSP is related to lower fatigue or less sleep impairments and more engagement, but also non-significant findings or positive correlations with health complaints were reported (Querstret and Cropley, 2012; Syrek et al., 2017; Vahle-Hinz et al., 2017; Jimenez et al., 2021). Thus, findings on the impact of PSP on health variables are still mixed.

The present study aims to clarify the effect of school restrictions on fatigue due to work-related rumination. As proposed earlier, teachers during the school restrictions should experience lower level of workload. Thus, it is expected that lower work-related rumination is present. As rumination is seen as a state and a trait-like tendency (Watkins and Nolen-Hoeksema, 2014), it is proposed that the effect can be found on the between- and within-level.

*Hypothesis 3:* Compared to the teachers before, the teachers during school restrictions have lower average levels of (a) PSP and (b) AR. This relationship is mediated by teacher-specific workload such that higher teacher-specific workload is associated with higher AR (c) and PSP (d) on the between-level. Higher teacher-specific workload is associated with higher AR (e) and PSP (f) on the within-level.

Following meta-analytic findings a lack of psychological detachment is found to mediate the effect between job demands and negative health outcomes (Bennett et al., 2018). Less is known about differential effects of different content of work-related rumination especially in the teaching context (Türktorun et al., 2020). As different study designs were used in the differentiation between the work-related rumination facets, such as cross-sectional studies or weekend studies, the present study aims to clarify the effect of both facets in a daily diary study. PSP is examined exploratory. Overall study assumptions can be seen in Figure 1.

*Hypothesis 4:* AR is related to higher levels of fatigue on the (a) between- and (b) within-level. PSP is related to fatigue on the (c) between- and (d) within-level. AR mediate the effect of teacher-specific workload on fatigue on the (e) between- and (f) within-level. PSP mediate the effect of teacher-specific workload on fatigue on the between- (g) and within-level (h).

## 2. Methods

### 2.1. Procedure and sample

The reported data were part of a research project on teachers' reflection on work. In the following sections, we only report data, which were necessary for this study and for the hypotheses (e.g., teacher-specific workload; work-related rumination; fatigue and demographic as well as school-specific variables). Data, which was not part of the hypotheses and research questions, are not reported (e.g., daily sleep quality, vitality, other psychological energy indicators, trait measures of recovery experiences and work-related rumination). The data collection took place from February to March 2020 (4 weeks before and 2 weeks during the restrictions starting with the 16th of March). Teachers from different schools within the same federate state (and therefore with the same restriction level, Steinmetz et al., 2020) in Germany (Hesse) were invited to participate in the study using the official email distribution list of partner schools of a university in Hesse and by the snowballing technique. The teachers were informed via e-mail about the procedure. Confidential data handling was guaranteed. The project, the present study was part of, was permitted by the Hesse Ministry



of Education and Cultural Affairs and the study adhered to ethical guidelines. As incentives, all participants received vouchers for an online warehouse and a feedback on their personal work strain patterns. The study was conducted using an online survey software allowing participation through various digital devices. The participants filled out an online questionnaire, which was mandatory for participating in the diary part of the study, and comprised for example demographic variables and general information about their work conditions (e.g., average working hours). A week later, the teachers received e-mail invitations and short message service (SMS) within standardized time frames to participate 5 days in the daily questionnaires from Wednesday to Monday morning. In the morning before starting work (05:00–08:30 a.m.), they rated their fatigue level. In the afternoon after school (03:00–06:15 p.m.) the teachers reported their teacher-specific workload. In the late evening (08:30–11:30 p.m.) they reported their work-related rumination. A total of 186 teachers registered for the study at different time points during February and March 2020 and therefore received the online questionnaire and the daily online diaries accordingly. Six teachers did not finish the general questionnaire or did not participate in the diary part of the study. Six teachers did not work or only worked once in the time frame of the study or stemmed from a different federal state and thus, were excluded. The final sample comprised 174 teachers (female = 80.5%; male = 19.5%;  $M = 40.29$  years old,  $SD = 9.45$ ). The amount of female teachers is typical for Hesse in which over 71% of the teachers in for example primary and secondary schools are female (cf. Hessisches Statistisches Landesamt, 2020). The teachers were from different school types (e.g., primary and secondary), taught a variety of school subjects and their teaching experience was between 1 and 37 years ( $M = 13.05$ ,  $SD = 8.38$ ). The participants were divided into two groups according to the date the school attendance was restricted. Group 0 ( $n = 138$ ) comprised teachers who participated in the weekly assessment before restriction of school attendance (4 weeks in total); group 1 ( $n = 36$ ) comprised teachers who participated in the weekly assessment during restriction of school attendance (2 weeks in total starting with the 16th of March 2020).

For the purposes of analysis, only those days (defined as data points with afternoon, evening and next morning measures) were included, in which the teachers specified that they had worked. Either

the report on work activity was indicated by at least one specification on the workload questionnaire in the afternoon (see below) or – in the case a teacher missed the afternoon questionnaire – by affirming in the evening that they had worked on that day. In total, 1,697 daily measures were collected: 565 in the afternoon (6.77% missing data) and 552 in the late evening (8.91% missing data) and 580 in the morning (4.29% missing data). All the data points, even the ones with missing data, were included (cf. Hox, 2010). The average cluster size was 3.48.

## 2.2. Measures

Descriptive statistics, reliabilities, and (intraclass-) correlations (ICC) of the primary study variables are shown in Table 1. McDonald's omega was used as a reliability estimate. All responses to the items were rated on a 5-point Likert scale, except for the items of the teacher-specific workload, which were rated on a 6-point Likert scale. Unless otherwise specified, mean scores were computed.

*Teacher-specific workload* was assessed by eleven items of the German teacher-specific workload scale by van Dick and Wagner (2001). The scale included eleven stressors, describing problems in the school context (e.g., too many students in class, student misbehaviour, problems with foreign students, difficulties with administration, problems with parents of the students). The items were slightly adapted so that they applied to the daily context. Teachers were asked to indicate how stressful they experienced each stressor on that given day from 0 (*not at all stressful*) to 5 (*very stressful*). As not all stressors might have been present on 1 day, the participants could indicate “not applicable.” The sum score of the teacher-specific workload per day was computed for all items on which the teacher rated the stress level.

*Work-related rumination.* The German version (cf. Hamesch et al., 2014) of the Work-Related Rumination Questionnaire (Croppley et al., 2012) was used to assess AR and PSP with five items each (cf. Weigelt et al., 2019). The items were slightly adapted to the workday evening: “This evening I became tense when I thought about work-related issues during my free time” (AR), and “This evening I found myself reevaluating something I have done at work in my free time” (PSP).

TABLE 1 Descriptive statistics, reliabilities and correlations of variables.

Variables	$M_b$	$SD_b$	$\omega$	ICC	1	2	3	4
1 Affective rumination	2.25	0.711–0.721 ( $M = 0.716$ )	0.886–0.899 ( $M = 0.894$ )	0.537				
2 Problem solving pondering	2.39	0.541–0.55 ( $M = 0.544$ )	0.759–0.859 ( $M = 0.813$ )	0.412	0.548** (0.439**) <sup>a</sup>			
3 Fatigue	2.26	0.654–0.657 ( $M = 0.656$ )	0.898–0.906 ( $M = 0.902$ )	0.479	0.585** (0.199**) <sup>b</sup>	0.332** (0.120**) <sup>b</sup>		
4 Teacher-specific Workload	16.5	7.01–7.06 ( $M = 7.03$ )	0.825–0.973 ( $M = 0.884$ )	0.366	0.510** (0.124*) <sup>b</sup>	0.394** (0.237**) <sup>b</sup>	0.439** (0.073) <sup>b</sup>	
5 Group					–0.433** <sup>a</sup>	–0.322 <sup>1a</sup>	–0.303 <sup>1a</sup>	–0.911** <sup>b</sup>

Standardized coefficients are presented for correlations. Coefficients are based on random intercept models with within-level correlations shown in parenthesis ( $n_{level2} = {}^{173-}{}^{174}$ ;  $n_{level1} = 552-606$ ). 1–4 was regressed on group as a predictor; age was included as a covariate. Group: 0 = teachers before school restrictions, 1 = teachers during school restrictions.  $\omega$  = McDonald's Omega ( $n_{afternoon} = 64-159$ ;  $n_{evening} = 62-150$ ;  $n_{next\_morning} = 66-158$ ).  $\omega$  of WL: Because of non-identification of the model, 4 days are reported (fixing one item-factor loading to 1 led to a  $\omega = 0.922$  in the excluded day).  $M_b/SD_b$  = estimated between-level mean and standard deviation based on random intercept models with FIML. ICC, intraclass correlation; <sup>1</sup> $p < 0.10$ , one-tailed; \* $p < 0.05$ , one-tailed; \*\* $p < 0.01$ , one-tailed.

*Fatigue in the morning.* Fatigue was measured by four items of the German Profile of Mood States (Albani et al., 2005). The participants rated adjectives (e.g., “exhausted”) according to their fatigue level from 1 (not at all) to 5 (extremely) in that moment.

### 2.3. Analyses

To analyse the composition of the two groups in demographic variables, all available data was used, and *t*-test and Chi-squared ( $\chi^2$ ) tests were conducted using IBM SPSS Statistics (Version 27). Moreover, the data had a hierarchical data structure since daily reports were nested within persons. The amount of variance in study variables lying between- and within-persons was inspected by the ICC. To consider the associations of restrictions of school attendance and potential mediating effects, multilevel structural equation modeling (MSEM) was used (cf. Preacher et al., 2010). All predictor variables (except group belongingness) were grand-mean centred. A stepwise approach was conducted. First, fatigue was regressed on group belongingness (model 1). Second, teacher specific-workload was included as a predictor of fatigue on the within- and between level (model 2). Third, work-related rumination facets were included as predictors of fatigue on the within- and between level. Both facets were regressed on group-belongingness and teacher-specific workload (model 3) Full information maximum likelihood estimation with a robust estimator in Mplus6 (Muthén and Muthén, 1998-2010) was used to deal with the missing data. Only saturated models were tested.

## 3. Results

### 3.1. Group composition in demographic and work-related variables

As shown in Table 2, there were no significant differences between the groups in most of the demographic and work-related variables as assessed with the general questionnaire. There were also no significant differences in group compositions such as school type,  $\chi^2(6) = 2.40$ ,  $p = 0.879$ , working part- or full-time,  $\chi^2(3) = 1.86$ ,  $p = 0.601$ , gender distribution,  $\chi^2(1) = 2.05$ ,  $p = 0.152$ , and relationship status,  $\chi^2(2) = 0.25$ ,  $p = 0.882$ . A significant difference was observed only in age, which was considered as a covariate in the models. There were no differences between the groups regarding the days the teachers participated and worked,  $\chi^2(4) = 1.79$ ,  $p = 0.774$  and no difference between the distribution in workday (0) versus weekend (1),  $\chi^2(1) = 1.55$ ,  $p = 0.213$ . The inclusion of “workday versus weekend” on the within level (model 2 and 3) did not change the results decisively. Therefore, the more parsimonious models were reported.

### 3.2. Preliminary analysis

The ICC of the level 1 variables (Table 1) indicated that it is appropriate and necessary to implement multilevel modelling as 36.6 - 53.7% of the variance of the level 1 variables was between-person variation (cf. Preacher et al., 2010). Correlations (Table 1)

TABLE 2 Group comparison in level 2 variables.

Variable	Group	M	SD	t-value (df)	95% CI
Age	0	39.35	9.17	-2.61* (172)	[-7.98, -1.11]
	1	43.89	9.76		
Amount of students in school	0	558.32	378.55	-0.56 (172)	[-144, 136.03]
	1	562.31	380.93		
Average amount of students in class	0	21.77	5.05	0.14 (172)	[-1.7, 1.96]
	1	21.64	4.57		
Average working hours per day	0	7.56	1.97	-0.001 (168)	[-0.72, 0.72]
	1	7.56	1.86		
Average working hours in school per week	0	28.08	13.66	0.66 (172)	[-3.42, 6.86]
	1	26.36	14.84		
Average working hours at home per week	0	11.36	16.6	0.84 (172)	[-3.24, 8.08]
	1	8.94	8.77		
Average working hours per weekend	0	5.09	4.76	0.51 (172)	[-0.88, 1.72]
	1	4.67	3.08		
Amount of children	0	1.10	1.08	-1.44 (172)	[-0.68, 0.11]
	1	1.39	0.99		

Group: 0 = teachers before school restrictions, 1 = teachers during school restrictions. CI = Confidence interval of difference. N = 170–174. For average working hours per day, four teachers were excluded because of unrealistic data (e.g., 24 h). \* $p < 0.05$ , two-tailed.

showed that higher PSP was related to higher fatigue on the between- and within-level. The within-level relationship between teacher-specific workload and fatigue in the morning was not significant. However, experiencing higher teacher-specific workload on average was related to higher average fatigue in the morning over the course of the working days. All other relationships were significant and in the expected direction.

### 3.3. Test of hypotheses

There was (cf. Table 1) a significant negative relationship between AR (Hypothesis 3b) and teacher-specific workload (Hypothesis 1) with group belongingness in the expected directions. There was also the tendency that PSP was related to group belongingness, even though the effect was not significant,  $\beta = -0.322$ ,  $SE = 0.207$ ,  $p = 0.06$  (Hypothesis 3a). In the first step (model 1), average fatigue in the morning was regressed on group belongingness. A significant effect was observed, indicating that teachers during the restrictions had on average significantly lower level of fatigue in the morning as compared

to teachers before the restrictions,  $\beta = -0.413$ ,  $SE = 0.212$ ,  $p = 0.026$ . However, when age was included as a covariate, the effect failed to reach significance,  $\beta = -0.303$ ,  $SE = 0.217$ ,  $p = 0.081$ . *Hypothesis 2a* was not fully supported. Older teachers experienced lower average level of fatigue in the morning,  $\beta = -0.241$ ,  $SE = 0.083$ ,  $p = 0.004$ . In the second step (model 2), teacher-specific workload was included. There was no effect on the within-level (*Hypothesis 2c*),  $\beta = 0.078$ ,  $SE = 0.061$ ,  $p = 0.103$ . However, the indirect effect of teacher-specific workload on the between-level was significant,  $\beta = -0.361$ ,  $SE = 0.145$ ,  $p = 0.007$ . Teachers during the restrictions experienced lower levels of teacher-specific workload on average compared to teachers before the restrictions,  $\beta = -0.895$ ,  $SE = 0.251$ ,  $p < 0.001$ . Lower levels of levels of teacher-specific workload was related to lower levels of fatigue in the morning,  $\beta = 0.403$ ,  $SE = 0.102$ ,  $p < 0.001$ . These results supported *Hypotheses 1* and *2b*. In the third step (model 3), the facets of work-related rumination were included into the model (Table 3).

*Between-level:* When including work-related rumination, the paths of group belongingness on AR and PSP were fully mediated by teacher-specific workload. Teachers during restrictions experienced on average lower levels of teacher-specific workload, which was associated with lower levels of AR,  $\beta = -0.451$ ,  $SE = 0.167$ ,  $p = 0.004$ , and PSP,  $\beta = -0.333$ ,  $SE = 0.14$ ,  $p = 0.017$ . These findings supported *Hypotheses 3c* and *3d*. There was no significant relationship between PSP and fatigue; PSP did not mediate the relationship between workload,  $\beta = -0.022$ ,  $SE = 0.045$ ,  $p = 0.618$ , or group-belongingness,  $\beta = -0.001$ ,  $SE = 0.013$ ,  $p = 0.967$ , and fatigue in the morning. *Hypotheses 4c* and *4g* were not supported. However, AR mediated the effect between teacher-specific workload,  $\beta = 0.273$ ,  $SE = 0.082$ ,  $p < 0.001$ , but not group belongingness,  $\beta = 0.011$ ,  $SE = 0.112$ ,  $p = 0.461$ , and fatigue. The direct path of teacher-specific workload on fatigue was no longer significant. Those teachers who on average experienced higher levels of teacher-specific workload reported higher levels of AR after work in the evening. Higher levels of AR were related to higher average levels of fatigue in the morning. *Hypotheses 4a* and *4e* were therefore supported. Exploratory, a three-path mediation from group belongingness over teacher-specific-workload and AR to fatigue in the

morning was tested. The effect reached significance,  $\beta = -0.239$ ,  $SE = 0.103$ ,  $p = 0.011$ .

*Within-level:* Higher teacher-specific workload was associated with higher AR and PSP on the within-level. *Hypotheses 3e* and *3f* were supported. PSP was not related to fatigue in the morning and there was no mediating effect of PSP in the relationship between teacher-specific workload and fatigue,  $\beta = 0.009$ ,  $SE = 0.014$ ,  $p = 0.536$ . *Hypotheses 4d* and *4h* were not supported. In support of *Hypothesis 4f*, there was a significant indirect effect of AR: Higher levels of teacher-specific workload were related to higher levels of AR on the within-level, which was related to higher levels of fatigue,  $\beta = 0.022$ ,  $SE = 0.012$ ,  $p = 0.04$ .

### 4. Discussion

The present study investigated the associations of restrictions of school attendance with recovery and stress experience of teachers. Following the E-RM (Meijman and Mulder, 1998) and especially the aspect of negative affect and negative activation (Sonnentag, 2018), it was hypothesized that teachers during restrictions would experience on average lower levels of teacher-specific workload, being associated directly to the level of fatigue in the morning and indirectly through work-related rumination. In implementing a diary study design and multilevel modelling, different aspects of the association and influence of school restrictions and differences in teacher-specific workload were emphasized. Considering age as a covariate, model 1 showed the tendency ( $p = 0.08$ ) that during restrictions teachers had lower average fatigue levels over the working days. In line with the E-RM (Meijman and Mulder, 1998) and deducible suggestions concerning negative (affective) activation (Sonnentag and Fritz, 2015; Sonnentag, 2018), model 2 showed that teachers during the first 2 weeks of the school restrictions experienced lower levels of teacher-specific workload on work days compared to the teachers 4 weeks before the school restrictions. Teacher-specific workload

TABLE 3 Multilevel structural equation model to test hypothesis (third model).

	Fatigue	Affective rumination	Problem-solving pondering	Teacher-specific workload
Parameter	Estimate (SE)	Estimate (SE)	Estimate (SE)	Estimate (SE)
<b>Between-person level</b>				
Group	0.051 (0.213)	0.021 (0.211)	0.009 (0.227)	-0.876 (0.253)**
Affective rumination	0.531 (0.118)**			
Problem-solving pondering	-0.059 (0.116)			
Teacher-specific workload	0.171 (0.140)	0.515 (0.099)**	0.380 (0.115)**	
Age	-0.240 (0.079)**	0.047 (0.081)	-0.040 (0.087)	-0.082 (0.094)
Intercept	3.45 (0.26)**	-0.01 (0.09)	-0.02 (0.1)	0.23 (0.1)
<b>Within-person level</b>				
Affective rumination	0.177 (0.059)**			
Problem-solving pondering	0.036 (0.058)			
Teacher-specific workload	0.037 (0.065)	0.123 (0.053)**	0.238 (0.053)**	

Standardized predictor coefficients are presented. There was a significant correlation between the work-related rumination facets on the between- ( $r = 0.449^{**}$ ) and within-level ( $r = 0.424^{**}$ ).  $n_{level2} = 174$ ;  $n_{level1} = 606$ . \* $p < 0.05$ , one-tailed; \*\* $p < 0.01$ , one-tailed.

was a significant mediator in the previous mentioned relationship between group belongingness and average level of fatigue. It is important to note that teacher-related demographic variables did not differ between the groups in the general questionnaire and could be ruled out as an explanation for differences between the groups in teacher-specific workload. It is also crucial to state that there was no difference concerning the distribution of working days and the weekend over the five-day span of the study. Therefore, it is not possible to conclude from the present study that teachers during the school restrictions worked on less days (average cluster size: Group 0 = 3.43; group 1 = 3.69). Even though a political decision changed the work situation of teachers on a specific day, the association of group belongingness and teacher-specific workload cannot be interpreted as causal. Nonetheless, it is reasonable to suggest that an association was present. On the one hand, this might be due to the fact that teachers being less exposed to teacher-specific demands such as large amount of students in class or student misbehaviour. On the other hand, restrictions of school attendance reduced the risk of being exposed to COVID-19 in class, which might explain a reduced stress experiences due to the teacher-specific job demands.

Model 3 showed that, higher teacher-specific workload was related to higher AR and higher PSP. Higher AR was related to higher levels of fatigue the next morning on the within- and between-level. PSP, however, was unrelated to fatigue level. Crucially, the association between teacher-specific workload and fatigue on the between-level was fully explained by AR. On the within-level, this indirect effect was significant as well. The findings emphasize the importance of AR in nonwork time for the negative effect of teacher-specific workload on fatigue level. Higher teacher-specific workload on average appears to be more important for fatigue level than experiencing a higher workload than usual on a specific day, as the between- but not the within-level association was significant in model 2. However, both might be detrimental, as it heightens the possibility of AR, which is related to higher fatigue level on both levels.

With regard to the COVID-19 situation of teachers, the three-path mediation showed that teachers during restrictions indirectly had favourable recovery experience and outcome, as lower levels of teacher-specific workload (in the afternoon) were associated with lower levels of AR in nonwork time (in the evening), which in turn was associated with lower average fatigue levels (in the next morning).

#### 4.1. Theoretical implications concerning work-related rumination

Model 3 showed that higher stress experience due to teacher-specific job-demands can lead to more fatigue, as recovery is hindered due to AR but not PSP. The results on the between- and within-level are further in line with the suggestion, that negative activation due to job demands, is sustained or accompanied by negative cognitions within AR (Sonnentag, 2018), which particularly hinder successful recovery. The present study adds to the recovery research in focusing on the differential effects of the content of work-related thinking in nonwork time (cf. Headrick et al., 2019; Jimenez et al., 2021). Especially AR appears to influence

fatigue level negatively. Overall, problem-oriented thinking did not relate to fatigue level. This contradicts the suggestions, which anticipated positive effects of problem-oriented thinking on recovery outcomes (Querstret and Cropley, 2012; Syrek et al., 2017; Headrick et al., 2019). However, even though PSP reduces the time for distancing from work, thinking about problem solutions in nonwork time neither lead to a heightened level of fatigue. Furthermore, PSP might not be related to negative recovery experiences or outcomes but could influence positive ones (Vahle-Hinz et al., 2017). The findings concerning AR and PSP are in line with theories in occupational health (Sonnentag, 2018) and clinical psychology (Querstret and Cropley, 2013) contexts indicating that the emotional response, evaluation of thoughts and negative activation, but not work-related cognitions *per se* are problematic.

#### 4.2. Practical implications

Restrictions regarding work in times of pandemics seems to be associated with recovery and stress experiences. It is feasible to suggest that COVID-19 related school restriction were associated with a decrease in teacher-specific workload and unfavourable and maladaptive work-related rumination processes that has short-term positive effects on the fatigue level of teachers. Short-term restrictions and sudden changes, therefore, might not necessarily have maladaptive outcomes in relation to psychological well-being for all occupations (cf. Chong et al., 2020). From another perspective, in the present study, teachers appear to be more stressed and rely more on unfavourable work-related thinking processes shortly before the restrictions of school attendance were decided. For example, Ministries of Education can establish regional task-forces who can act quickly in exceptional situations and provide teachers with the necessary information shortly before, as compared to shortly after restrictions. Giving clear information about the next steps might increase controllability, and reduce negative affect and maladaptive thinking processes about tasks that are to be completed.

In the study of work-related thoughts in nonwork time, occupation-specific job demands and workload are rarely included (Türkötürün et al., 2020). This makes it difficult to draw conclusions on the impact of specific demands (e.g., teaching in class, working with parents) and how they relate to stress and recovery experience. Including teacher-specific workload and differentiating between the groups before and during the restrictions provided important information and sheds light on an important topic above the COVID-19 situation. Stress experience due to teacher-specific job demands indeed is associated with adverse recovery experience and outcome. Groups with different kinds and presumably varying degrees of stressful school situations experience corresponding recovery experience and outcome. The organization of the school situation therefore appears to matter for the health of teachers. Recently there is growing debate concerning the community level of a possible modification of the situation of teachers (Viac and Fraser, 2020). The present study indicates that on the individual level, teachers should draw attention to techniques that helps in reducing AR. Although limited, there is evidence that for example mindfulness-based interventions reduce (work-related) rumination (Karabinski et al., 2021). Focusing on boundary management and



sleep as well as emotion regulation interventions might be equally favorable, while more intensive trainings appear to be more effective (Karabinski et al., 2021).

### 4.3. Limitations and further future research directions

This diary study helped in finding differences between the groups in teacher-specific workload, fatigue, and AR throughout working days. Moreover, the diary design provides for a more robust testing of effects on health-related indicators in times of pandemics (cf. Rudolph et al., 2021). However, because of the original aim and plan of the study, only short-term effects based on unequal sample sizes in each group could be provided. It has to be noted that the tests of between level effects are based on the whole sample and not on the subsample of the groups and that robust estimators (Muthén and Muthén, 1998-2010) were used. Future research should add data on the long-term effects of restrictions on teachers' and employees' mental health. Besides occupational health, effects on the performance of employees should be considered. Furthermore, even though we found a large effect between the group variable and teacher-specific workload ( $-0.876$ ), there might be other moderating or influencing factors involved. For example, our data could not provide information on the COVID-19 health anxiety (Trogakos et al., 2020) of teachers. The fear of apprehending COVID-19 might have moderated the effect of the group variable on teacher-specific workload, such as teacher-specific workload appeared even higher for teachers high in COVID-19 health anxiety shortly before the lockdown. Furthermore, acceptance of technology (Venkatesh and Davis, 2000) or information and communication technology skills (Engelhardt et al., 2021) might have acted as a buffering personal resource for teachers when providing digital content during the weeks of school restrictions. Future research should examine, whether workload for teachers providing digital education is different according to person-specific competencies or beliefs.

In the work context of teachers, the effect of asynchronous teaching on students' performances is crucial as well (Kuhfeld et al., 2020; König and Frey, 2022). Both aspects should allow insights into how teaching can be implemented in times of pandemics, and if and under which circumstances distance teaching might have positive community- (e.g., reaching rural area students) and health-related consequences (possible first hints, e.g., American Psychological Association, 2020; Zhang et al., 2020; König and Frey, 2022).

Future research might also add negative affect as an indicator of negative activation, as one central antecedent (cf. Sonnentag, 2018), which has not been considered here. Moreover, personality traits have not been considered. In view of the emphasis of negative affective activation, neuroticism might be crucial factors in the relationship of job demands, perseverative cognitions and negative affect (Lahey, 2009). Beside lower levels of teacher-specific workload, working time and the possibility of longer recovery time, daily setbacks (Chong et al., 2020) as well as levels of unfinished goals—due to less school responsibilities, might be the

additional factors, which should be worth examining in future research.

## 5. Conclusion

The present study provides evidence for the association of differences in work situations due to restrictions with the workload and fatigue level and recovery experiences of teachers. Teachers during the school restrictions experienced lower teacher-specific workload and indirectly lower levels of fatigue as compared to the teachers before the restrictions. The results further showed that lower levels of AR explained the effect of teachers-specific workload on the fatigue level. AR appears to be more important for fatigue levels compared with PSP, which did not have a direct effect on the fatigue levels of teachers.

## Data availability statement

The dataset used in the present article is not available because the participating teachers were guaranteed that the data would not be passed to third parties. Requests to access the datasets should be directed to [weiher@psych.uni-frankfurt.de](mailto:weiher@psych.uni-frankfurt.de).

## Ethics statement

The studies were conducted in accordance with the local legislation and institutional requirements. All participants provided their written informed consent to participate in this study.

## Author contributions

GW and YV were responsible for designing the study, conducting the study, data collection and -management. HH supervised the mentioned process. GW was mainly responsible for writing this article and conducting the statistical analysis. YV and HH helped editing and reviewing this article. All authors contributed to the article and approved the submitted version.

## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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