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Mind the Teachers! The Impact of Mindfulness Training on Self-Regulation and Classroom Performance in a Sample of German School Teachers

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Abstract: Teacher wellbeing and performance is affected by their ability to cope with the demands of the profession. This pilot non-randomized, waitlist-controlled study investigated the impact of a mindfulness intervention (Mindfulness-Based Stress Reduction) on teachers' wellbeing, self-regulation ability and classroom performance applying a mixed-method design. The sample was comprised of 32 German school teachers (93% female) which were distributed to a control and intervention group. Compared to the control condition, the intervention showed medium to high effect sizes on most outcome variables at post-test and results were sustained at follow-up. Mediation analyses showed that changes in mindfulness at post-test mediated changes in outcome variables at follow-up. Unexpectedly, the intervention seemed to negatively affect teacher engagement. Qualitative interviews highlighted the way mindfulness may influence teacher engagement and improve performance. Limitations of this study and future directions of research are discussed.

Keywords: *MBSR, teacher education, teacher training, mindfulness, meditation*

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Introduction

The high prevalence of teacher stress has been a major international challenge (Kyriacou, 1987, 2001). Chronic teacher stress has a negative impact on teachers' health (Guglielmi & Tatrow, 1998; Rothland, 2007, 2012) and may be contributing to high teacher leave (UK: Allen, Burgess, & Mayo, 2012; USA: Goldring, Taie, & Riddles, 2014) as well as early retirement of teachers in Germany (Weber, 2004). A large number of studies have highlighted factors associated with traits of personalities and attributes of schools that contribute to teacher strain (e.g. Abele & Candova, 2007; Brouwers & Tomic, 2000; Grayson & Alvarez, 2008; Pas, Bradshaw, & Hershfeldt, 2012). Despite the high number of studies documenting teachers' stress and strain, to date few studies investigated how teachers can be supported so that they can cope with the demands of the profession.

To cope with the demands of the professions, teachers need skills to both sustain health and perform well as teachers. In Germany, the ability for self-regulation has recently been identified as an aspect of professional competence of teachers (Baumert & Kunter, 2013). In motivation theory, the process of self-regulation is usually described as the ability to initiate, coordinate, and govern behaviour in accordance with personal goals (Ryan, Kuhl, & Deci, 1997). This ability is regarded as central for health promotion (Bandura, 2005). In the context of teacher training, the term *self-regulation* refers more generally to the capability of teachers to "manage their own resources in a professional setting" (Klusmann, 2013, p. 293).

A good self-regulation of teachers is an important prerequisite of successful classroom outcomes (Paulus, 2007, 2011). For example, in a representative German sample of math teachers, less than a third of teachers showed a healthy self-regulation which the authors defined as being highly resilient to the demands of the profession as well as highly engaged in the classroom (Klusmann, Kunter, Trautwein, Lüdtke, & Baumert, 2008). Interestingly, the teachers displaying healthy self-regulation not only showed better health outcomes compared to teachers with less healthy patterns; their instructional quality was also rated significantly higher by their students.

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Research on teacher stress and wellbeing identified key self-regulation skills, for example self-efficacy and emotion regulation (Abele & Candova, 2007; Baumert & Kunter, 2013; Berking, 2010; Rothland, 2013b; Sieland, 2006).

Teacher Self-efficacy is the belief to be able to handle difficult classroom events in the future for teachers in the classroom in particular (Bandura, 1997). This belief affects the choices people make, the goals they set for themselves, the effort they put into their work, and their perseverance in the face of difficulties. Two meta-analyses showed that self-efficacy of teachers is positively linked to student learning motivation and student self-efficacy as well as teacher motivation and teacher health outcomes (Kagan, 1992; Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). In a longitudinal study, Brouwers and Tomic (2000) showed that a low sense of self-efficacy in teachers predicted burnout five years later. In fact, burnout has been described as a crisis of self-efficacy (Leiter, 1992).

Emotion regulation. Emotion regulation is the ability to show certain emotions and hide or regulate others (Gross & Muñoz, 1995). Teaching is regarded as emotional work and teachers need to regulate their emotions frequently (Hargreaves, 1998; Hochschild, 1979). Brackett and colleagues (Brackett, Palomera, Mojsa-Kaja, Reyes, & Salovey, 2010) found that emotion regulation ability of teachers was positively associated with job satisfaction, positive affect, and principal's support. In a large-scale qualitative study, Sutton, Mudrey-Camino and Knight (2009) showed that teachers were aware of the importance of emotion regulation but thought they sometimes lacked the skills to regulate negative emotions. Emotionally exhausted teachers were also more likely to describe student behaviour as disruptive (Kokkinos, Panayiotou, & Davazoglou, 2003). Furthermore, the more often teachers experienced negative affect in the classroom, the more negative students rated their instructional quality (Frenzel, Goetz, Stephens, & Jacob, 2009).

Mindfulness as a Foundation for Healthy Self-Regulation

How can self-regulation be improved? Brown, Ryan, und Creswell (2007, p. 218) described mindful awareness as a "foundation for healthy self-regulation." A recent review of the neuroscience of mindfulness suggest that the practice of mindfulness may impact self-regulation by improving the regulation of attention and emotions (Tang, Hölzel, & Posner, 2015).

Mindfulness is the ability to purposefully pay attention to the present moment in a non-judgmental way (Kabat-Zinn, 1991, 2003). Originally a Buddhist concept, mindful awareness describes a generic psychological faculty. It may be directed to bodily sensations as well as to emotional and cognitive experiences (Thera, 1975). Mindfulness is not only about being aware; it is also about how individuals relate to a given situation. In a mindful state people experience acceptance of a given situation. For instance, resistance or avoidance of a negative emotion is likely to enhance or prolong the experience while mindful acceptance has shown to calm emotions (Berking, 2010). Therefore, mindfulness might reduce reactivity to negative emotions which is highly pertinent to the way teachers interact especially with challenging pupils.

Mindfulness is a state of mind that most people can attain, but in order to maintain it for longer periods of time, it needs practicing, for example through mindfulness meditation. A popular and secular way to train mindfulness is Mindfulness-Based Stress Reduction (MBSR) training. MBSR is a group training program aimed at alleviating suffering from stress-related symptoms, illness, anxiety, and chronic pain (Kabat-Zinn, 1991). MBSR is presented as a structured 8-week course with weekly group meetings that range from 2.5 to 3 hours in length and an additional immersion. Its main goal is to help people develop mindfulness. Aided by group practice and audio recordings for home practice, participants experience and reflect on mindfulness meditations such as observing the breath, scanning the body to become aware of body sensations, and walking mindfully. Furthermore, topics related to stress are presented (Chaskalson, 2014; Stahl & Goldstein, 2010).

Evidence shows that MBSR effectively reduced stress and alleviated psychological and physical symptoms of stress in both clinical and healthy populations (Chiesa & Serretti, 2009; Grossman, Niemann, Schmidt, & Walach, 2004; Khoury et al., 2013). The program requires a high practice commitment: Participants are asked to practice 40 minutes of formal meditation on six days per week. A recent meta-analysis concluded that the time spent on home practice was linked to improvements in mindfulness, well-being, and stress-related symptoms (Parsons, Crane, Parsons, Fjorback, & Kuyken, 2017).

Review of Impact of MBSR for Teachers

As indicated by the publication of recent studies, there is a growing interest in the impact of mindfulness training for teachers. While some studies are based on other training formats or apply meditation techniques that are possibly not comparable to mindfulness meditation (Anderson, Levinson, Barker, & Kiewra, 1999), the four studies reviewed here use MBSR training or slightly modified trainings for teachers.

In a qualitative pilot study, three primary school teachers (all female) and their students participated in a year-long mindfulness training (Napoli, Krech, & Holley, 2005). Firstly, teachers completed MBSR training. Secondly, students took part in mindfulness training for nine months. The study examined the connection between teacher stress and teaching quality. Study participants reported that the training helped them to teach in a less fragmented manner. For example, they indicated that they were now directing their attention more on the process of teaching rather than the goal of the class. Due to this shift, teachers felt less exhausted and more closely attuned to the needs of their students.

In another preliminary evaluation, eleven primary teachers (91 % female) took part in MBSR training (Gold, Smith, Hopper, & Herne, 2010). Participants reported a decrease in levels of stress and in symptoms of depression at post-test compared to pre-test. However, the study design did not include a control condition.

A more recent study by Flook et al. (2013) randomized 18 teachers (all female) to a control (n=8) and intervention group (n=10). The intervention was slightly adapted to the needs of teachers and included additional teacher-specific content and a higher variability of practice duration times (e.g. 10, 15, 20 minute meditations). Participants were asked to complete measures of burnout, mindfulness, and self-compassion at pre- and post-test and to take part in computerized tasks related to attention and emotion regulation. In addition, classroom teaching practices were observer-rated, and saliva samples for cortisol were obtained as an objective indicator of stress. The intervention group showed significant improvements in perceived stress, mindfulness, self-compassion and burnout. Observers noted improved class-management skills in the intervention group but not in the control group. However, no changes were observed concerning other classroom skills. Teachers included in the intervention group were less prone to implicit bias after the training compared to those in the control group. Effect sizes (Cohen's d) of outcome measures were moderate to high. Despite the limited power due to small sample size, the study showed for the first time that a modified MBSR training may have a positive impact on both teacher health and classroom-management.

Roeser et al. (2013) randomized 113 public school teachers from Canada and the USA (89% women) to control (N=59) and mindfulness-intervention groups (N=54). The intervention was a slightly adapted version of MBSR. The study showed that mindfulness training for school teachers was feasible in terms of their ability to comply with home practice and completion of the program (87% completed the program). In addition to psychological indicators of stress, the study also considered physiological measures such as heart rate and cortisol level. Compared to control group, teachers of the mindfulness intervention reported greater improvements in measures of mindfulness, self-compassion, and considerable reductions in occupational stress and symptoms of burnout, anxiety, and depression. Objective measures of focused attention and working memory capacity increased significantly in the intervention but not in the control group. However, the effect sizes between groups were small for these measures. Changes in mindfulness and self-compassion at post-test mediated effects of the intervention on reductions in stress, burnout, anxiety, and depression at the 3-month follow-up. However, no positive training effect on physiological indicators of stress such as blood pressure, resting heart rate, and cortisol level was detected.

While this and the other results discussed above are promising, studies focusing on the impact of MBSR on teacher self-regulation and classroom performance are lacking.

Purpose of Study

In this trial, we investigated the impact of MBSR training with a teacher sample from Germany on self-regulation and professional performance. We assumed that increased trait-mindfulness after a mindfulness training will have a positive effect on self-regulation abilities, and this improvement, in turn, will lead to greater teacher health and teacher performance (Figure 1).

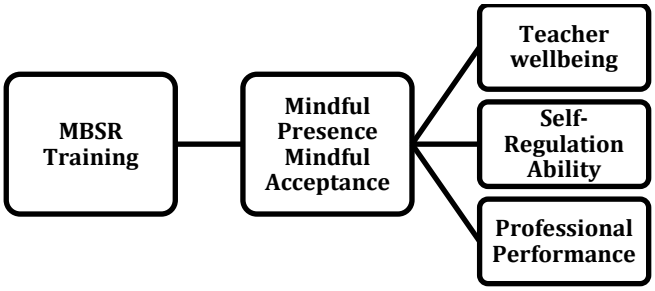

Figure 1. Logic Model of the Effect of MBSR on Health Outcomes and Professional Performance

We addressed the following research questions:

1) Do teachers who take part in MBSR regard it as beneficial? Do they complete the training, do they comply with home practice, and would they recommend the program?
2) Do teachers assigned to MBSR intervention group show greater increases in mindfulness compared to those of the control group?
3) Do teachers assigned to MBSR intervention group show greater improvements in teacher health and self-regulation ability than those in the waitlist-control group?
4) Do group differences in mindfulness at post-test mediate the training impact on self-regulation at 3-month follow-up?
5) Do teachers notice changes in their professional performance that they attribute to MBSR?

MBSR Training

The standard MBSR curriculum was delivered by a trainer with over 10 years of experience in delivering this mindfulness intervention. The programme structure was adapted to the school year schedule. Therefore, the training lasted 5 weeks and was delivered in four 2.5-hour evenings and two 8-hours days (total of 26 hours). The MBSR curriculum is comprised of mindfulness meditation practices and mindfulness in daily life. Every course session focuses on a topic such as coping with stress or working with difficult emotions. The programme contents and structure is described in more detail by Kabat-Zinn (1991) and Chaskalson (2014).

Methodology

Procedure

This study took place in Hamburg, Germany in 2011 and 2012. We conducted a quasi-experimental, non-randomized, waitlist-controlled study combining quantitative and qualitative data in a mixed-method design. The Public Institute of Teacher Education in Hamburg (LI Hamburg) advertised the training via their course website and email lists. Generally, all teachers of publicly funded schools based in Hamburg were eligible for participation. However, we held a mandatory pre-training information session for interested teachers. During this session teachers were introduced to the study design, the MBSR training and the importance of making time for personal practice. After the information teachers could register their interest in participation. Randomization of sample proved not possible due to limited availability of some teachers. To secure comparability of baseline tests, we distributed the sample by age and school type into intervention and waitlist-control group. MBSR training took place at the teacher training institution and teachers received the training for free. Hours spent at training sessions and filling out questionnaires were credited against teachers' compulsory requirement to engage in 30 to 45 hours of continuing education training per year. Teacher assigned to the intervention group completed the MBSR training in the autumn of 2011 (September to November). Teachers of the wait-list control group took part in the training in spring 2012 (April to June). There were three assessment times for both groups: pre-test (September, 2011), post-test (November, 2011), and 3-month follow-up (March, 2012).

Participants

The pre-assessment scores of one teacher of the control group were missing. This teacher had to be eliminated from the data. The final sample comprised 32 school teachers (n=30, 94% female) that were assigned to an intervention group (n=18) and a waitlist control group (n=14). Groups did not differ statistically. Descriptive information can be found in table 1. One post-assessment of the control group as well as one follow-up assessment of the intervention group was not returned. This resulted in slightly differing data sets for pre-post-test comparisons (Intervention: n=18, Control: n=13), and pre-follow-up comparisons (Intervention: n=17, Control: n=14).

Table 1: Demographics by Condition

Demographic Characteristics	Mindfulness Group	Wait-List Control Group
Number of Teachers (N=32)	18	14
Sex (% female)	100.0	85.7
Age in years, mean (SD)	45.9 (SD = 9,5)	49.3 (SD = 9.9)
Years of Professional Experience, mean (SD)	14.9 (SD = 9.7)	18.1 (SD = 12.1)
Working part-time (%)	66.7	50.0
School type (% elementary school)	27.7	28.6

Measures

Mindfulness

The Freiburg Mindfulness Inventory (FMI-14) is an instrument for measuring trait-mindfulness (Walach, Buchheld, Buttenmüller, Kleinknecht, & Schmidt, 2003, 2006). The short version of the inventory comprises 14 items and is frequently used to evaluate changes in mindfulness with meditation novices. The FMI measures two aspects of mindfulness: mindful presence and mindful acceptance. Mindful presence is characterized by the ability to stay present or to return to the present moment when absent-minded. Mindful acceptance involves embracing negative experiences. Based on a recent item response analysis (IRT), (Sauer, Strobl, Walach, & Kohls, 2013) suggested to leave out the negatively worded item 13 (*„I am impatient with fellow human beings.")* in order to increase construct validity and internal consistency. Using 13-items, the total mindfulness scales and both subscales were statistically reliable at pre-test (mindful presence: α=.83; mindful acceptance: α=.84). A higher mean score indicates higher trait-mindfulness.

Wellbeing of Teachers

Wellbeing of teachers was measured using a short version of the General Health Questionnaire (GHQ – 12)(Goldberg, 1978; Linden, Maier, Achberger, & Herr, 1996). This widely used scale assesses the overall wellbeing relative to a person's normal situation. It has also been used as a general screening for psychopathology. Participants rated their ability to concentrate, sleep well, and get things done as well as their feeling low self-esteem, or unhappy. Items were rated on a 4 –point metric (e.g. for assessing the quality of sleep: 0=not at all, 1=not worse as usual, 2=worse than usual, 3=much worse than usual. Answers were recoded in a bimodal way (0-0-1-1) to attain a sum score (0-12). A higher sum score indicated lower wellbeing of teachers. Internal consistency was good (α=.88).

Teacher Strain

Teacher strain was assessed with the Irritation Scale (Mohr, Müller, & Rigotti, 2005; Mohr, Müller, & Rigotti, 2007). This 12-item scale is designed to capture symptoms of strain resulting from an imbalance of personal resources and professional stress. The scale is widely used in non-clinical and professional settings for introducing health interventions and prevention. We used a teacher-specific version of the scale that measures two aspects of teacher strain. *Cognitive irritation* assesses the ability for mental self-regulation. Possibly a preliminary stage to rumination, cognitive irritation involves being unable to stop thinking about work-related problems – even during school holidays. *Emotional Irritation* is characterized as the result of a continuous depletion of resources. It includes items relating to the negative outcome of professional social interactions, such as reacting irritably or feeling like a 'nervous wreck'. Items were rated on a 7-point metric of frequency. The sum scores were converted into stanine scores based on a representative teacher sample provided by the authors. Internal consistency is adequate (irritation total α = .80, cognitive irritation α = .82, emotional irritation α = .79)

Occupational Stress and Coping Inventory

Occupation Stress and Coping Inventory (AVEM): The AVEM is a 44-item scale that assesses the ability to cope with professional challenges (Schaarschmidt & Fischer, 2006). In Germany, the AVEM is widely used in teacher health research and other professional contexts. The 44 items comprise 11 scales that differentiate into three dimensions of occupational coping behaviour: 1) resilience 2) work engagement 3) emotions regarding the professional setting. In this study, we focused on teacher resilience and work engagement. Teacher resilience was measured with three scales with adequate or good internal consistency: Ability to switch-off from work problems (α = .78), Tendency to resign in the face of strain (α = .90), internal calm and balance (α = .62). The dimension "work engagement" comprised four scales with decent reliability: importance of work (α = .78), professional ambition (α = .78), readiness to work hard (α = .86), and striving for perfection (α = .89). The scale offers standard values for a conversion of the 5-point likert scale into stanine scale based on large teacher samples.

Self-Efficacy

Self-efficacy is defined as the personal conviction to possess the necessary competences in order to cope with future difficulties in daily life (Bandura, 1997). It was assessed with a 10-item scale (Schwarzer & Jerusalem, 1999). Items were rated on a 4-point metric. Internal consistency of the scale was good (α = .86).

Emotion regulation

Emotion regulation skills were assessed using the Scale for Emotional Competence SEK-27 (Berking & Znoj, 2008). Originally comprised of 27 items that may be added up to 9 scales, we only measured the core competences as outlined

in Berking (2010). These competences are clarity of emotion, awareness of bodily sensation and awareness of emotion. In addition, we used a scale measuring general emotion regulation competence. Each scale is comprised of 3 items that are positively worded. The instrument is available in a trait and in a state-version. To increase sensitivity to changes, we used the state-version of the scales that is introduced with the phrase: "In the last week [followed by the the item, e.g.: *I regulated my emotions well*]." (1=not at al, 2=rarely, 3=sometimes, 4=often, 5=always). Internal consistency of all scales was good (awareness of emotion α = .86, awareness of bodily sensation: α = .80, clarity of emotion= α = .65, emotion regulation competency: α = .89). A higher mean score indicates a higher emotion regulation competence.

Emo-Check: Emo Check assesses positive and negative affect. The instrument is available online (http://www.tekonline.info). Participants receive a list of emotions and assess how often they experienced these emotions in the last week (1 = never, 2 = rarely, 3 = sometimes, 4 = often, 5 = always. The prevalence of positive emotions was assessed with two scales: positive emotion scale (α = .88) and coping emotion scale α = .93. The prevalence of negative emotions was assessed with the scales depressiveness (α = .78), fear (α = .72) and stress (α = .78). A higher mean score indicates higher prevalence of this emotion in the last week.

Mindfulness Practice Compliance

Participants in the mindfulness training group completed practice logs on a daily basis. Participants recorded the type of practice (e.g. bodyscan), the number of minutes per day spent engaging in that practice. Composite variables were created to examine both minutes per day of formal practice, frequency of mindfulness practice and type of mindfulness practice.

Completion of Program and Satisfaction with Program

The program was regarded as „completed", if a participant did not miss more than two group meetings. Satisfaction with the programme was assessed with 2 items: 1) "I have personally profited from the training." 2) "I am definitely going to recommend this training to others." 3) "I think that my students have profited from me taking part in the course."

Statistical Analysis

t-Tests for paired samples were conducted on outcome measures to determine the significance of changes within the groups. To provide a metric for between-group comparisons, Cohen's (1988) *d* was calculated. To control for pre-test differences the analysis was based on change scores as suggested by Hager (2004). First, we calculated two change scores for each outcome measure (post-test-pre-test, and follow-up-pre-test). Second, we computed *d* based on post-test and follow-up change scores and corresponding pooled standard deviations using standard methods. To evaluate if changes in mindfulness mediate changes in self-regulation ability we used standard procedures for mediational analysis (Baron & Kenny, 1986; Bühner & Ziegler, 2009). To analyse the qualitative interviews, interviews were transcribed and examples given were grouped into themes.

Results

Training Satisfaction and Compliance

Our first research question was whether participants found the training beneficial in terms of participation, practice compliance and recommendation of the program. 17 of the 18 course attendees completed the training. One participant of the intervention group dropped out after the first session. The reason she gave was that she was too busy and couldn't commit to the course. Participation in course sessions was high: 9 participants (52.9 %) took part in all course sessions, 6 (35.3%) missed one session, and 2 (11.8%) missed two sessions – mostly due to illness.

Reported practice compliance was high. 15 participants of the intervention group returned their homework log highlighting the amount of time they engaged in home practice. Participants were asked to practice on 6 days a week during the 5-week course. Calculations are based on a total of 30 possible practice days. Formal meditation exercises were practiced on average on 24.1 days (SD=5.2) or 80% of designated practice days. On average, participants engaged in 29.7 minutes of formal practice per day (SD=10.2). In total, participants meditated on average 14.8 hours (SD=5.1) over the span of the course. Participants practiced sitting meditation on average 16.6 times during the course, followed by bodyscan (13 times), yoga (6.6 times), and walking meditation (once). They also engaged about 5.2 times in informal practices, such as mindful eating. However, the two participants that did not return their homework log may not have practiced.

Sixteen of the seventeen attendees (94.1%) found the programme rather or very beneficial, while one attendee did not personally benefit from it. Twelve of the teachers (70.6%) found that the students benefited from them taking part in it as well. Fourteen participants (82.3%,) would recommend the course highly to fellow teachers, one participant disagreed strongly, and two participants were unsure (*Mean*(16)=4.18, *SD*=1.07). In the qualitative interviews, teachers highlighted that while they benefited they thought the course is "not for everyone" indicating that it should be offered only to interested teachers rather than making it a prerequisite.

Intervention effect on teacher mindfulness, strain and self-regulation ability

MBSR's main objective is to train mindfulness. Therefore, our second research question was whether MBSR significantly improves the ability of teachers to be mindful. *t*-Tests revealed that teachers in the intervention group reported greater mindful presence and mindful acceptance at post-test and 3-month follow-up than controls. The between-group effect sizes were large for both post-test and follow-up (Table 2).

Table 2: Changes in Mindfulness

	MBSR Pre- Posttest				Control Pre- Posttest				Cohen's *d*
	M (SD)		t_{16}	*p*	*M (SD)*		t_{13}	*p*	*d*
FMI-MP	2.15* (0.51)	2.92 (0.38)	**5.69**	<.001	2.61* (0.53)	2.56 (0.48)	-0.55	. 59	1.78
FMI-MA	2.15 (0.39)	2.71 (0.33)	**5.66**	<.001	2.39 (0.52)	2.47 (0.52)	0.87	.40	1.29
	Pretest Follow-Up				Pretest Follow-Up				
	M (SD)		t_{16}	*p*	*M (SD)*		t_{12}	*p*	*d*
FMI-MP	2.21 (0.61)	2.74 (0.35)	**3.23**	.005	2.60 (0.55)	2.45 (0.40)	-0.98	.35	1.11
FMI-MA	2.12 (0.35)	2.58 (0.41)	**4.76**	<.001	2.42 (0.53)	2.44 (0.52)	0.19	.85	1.20

Scales: FMI-MP Freiburg Mindfulness Inventory Mindful Presence, FMI MA Mindful Acceptance
*Statistically significant differences between groups at pre-test (p<.05).
Paired *t*-Tests for within group differences, significant changes (*p*<.05) in bold marks. Cohen's d computed comparing change scores of treatment and control using pooled standard deviation. Directions of Cohen's d were modified so that larger positive ds indicate superiority of the intervention group over the control group. *d*>0,20 = small effect; *d*>0,50 = medium effect, *d*> 0,80=large effect

Our third research question focused on whether mindfulness training would decrease teacher strain and improve self-regulation ability of teachers. Descriptive statistics, paired sample *t*- and *p*-values, and Cohen's *d* are reported separately for post-test (table 3) and follow-up (table 4). At pre-test, groups differed statistically significantly in some outcome measures that are reported in table 3 and table 4. Generally, teachers in the intervention group showed greater strain and less self-regulation ability compared to control group teachers. Therefore, we applied change scores to calculate between-group effect sizes.

Table 3: Effectiveness of MBSR at Post-test

Teacher Strain and Self-Regulation Measure	MBSR Pre M *(SD)*	Post M *(SD)*	t_{16}	*p*	Control Pre M *(SD)*	Post M *(SD)*	t_{13}	*p*	Cohen's *d* *d*
GHQ 12	4.59 (3.73)	1.65 (2.50)	**2.68**	.02	3.39 (3.15)	2.64 (2.59)	1.22	.25	0.39
CI	6.94 (1.68)	5.65 (2.00)	**-4.22**	.001	5.86 (1.79)	6.29 (1.64)	1.58	.14	1.51
EI	5.88* (1.41)	5.00 (1.37)	**-3.27**	.005	4.85* (1.34)	5.46 (1.45)	1.98	.07	1.34
AVEM-SR	5.50 (2.31)	6.19 (1.87)	**1.90**	.08	6.17 (2.44)	5.67 (2.74)	-1.03	.32	0.76
AVEM-TR	7.24* (1.95)	5.59 (2.03)	**-4.81**	<.001	5.31* (2.21)	5.38 (2.36)	0.16	.88	1.09
AVEM-PP	3.33 (2.09)	3.47 (1.64)	0.27	.79	3.31 (1.70)	3.38 (1.81)	0.19	.86	0.03
AVEM-IC	2.94* (1.18)	3.81 (1.68)	**2.21**	.04	4.07* (1.73)	4.36 (2.34)	0.62	.55	0.36
AVEM-IW	3.75 (2.11)	3.19 (1.91)	-1.42	.18	4.79 (2.01)	4.71 (2.02)	-0.25	.81	-0.40
AVEM-WA	4.53 (1.91)	4.59 (2.00)	0.17	.86	4.85 (2.23)	5.00 (2.12)	0.52	.61	-0.07
AVEM-WE	5.06 (2.27)	3.94 (2.52)	**-2.92**	.01	4.85 (2.94)	5.31 (2.84)	1.90	.08	-1.52
AVEM-SP	4.19 (2.61)	3.19 (2.04)	**-3.30**	.005	4.50 (2.44)	4.36 (2.47)	-0.41	.69	-0.48
GSE	2.61 (0.32)	2.81 (0.30)	**2.41**	.03	2.74 (0.42)	2.75 (0.54)	0.07	.94	0.55
TSE	2.69 (0.43)	2.91 (0.32)	**3.71**	.002	2.96 (0.46)	2.85 (0.33)	-1.11	.29	1.08
EC-AE	3.35 (0.69)	4.09 (0.44)	**3.58**	.003	3.33 (0.85)	3.29 (1.12)	-0.15	.89	0.85
EC-CE	3.42* (0.48)	3.75 (0.41)	**2.24**	.04	3.89* (0.61)	3.75 (0.45)	-0.77	.46	0.77
EC-FS	3.31 (0.85)	3.81 (0.60)	**2.45**	.03	3.59 (0.72)	3.38 (0.74)	-0.84	.42	0.83
EC-AR	2.71 (0.74)	3.31 (0.58)	**3.21**	.006	2.98 (0.63)	3.00 (0.76)	0.13	.90	0.79
EMO-DEPRI	2.39 (0.79)	1.71 (0.70)	**-3.17**	.006	2.10 (0.79)	1.76 (0.84)	-1.17	.26	0.36
EMO-ANGST	3.10 (0.59)	2.43 (0.69)	**-3.17**	.006	2.79 (0.75)	2.56 (0.77)	-1.04	.32	0.52
EMO-STRESS	3.65 (0.80)	2.90 (0.72)	**-3.28**	.005	3.36 (0.74)	3.33 (0.75)	-0.10	.92	0.80
EMO-COPING	3.22 (0.57)	3.62 (0.59)	**2.68**	.02	3.31 (0.66)	3.49 (0.56)	1.03	.32	0.34
EMO-POS	2.91 (0.56)	3.54 (0.57)	**4.22**	.001	3.24 (0.58)	3.36 (0.71)	0.65	.53	0.82

Scales: *GHQ 12 General Health Questionnaire, CI Cognitive Irritation, EI Emotional Irritation, AVEM SR Ability to stop ruminating, AVEM-TR Tendency to resign (in the face of failure), AVEM-PP Proactive problem-solving, AVEM IC Inner calm and balance, AVEM-IW: importance of work, AVEM-WA-Work-related ambition, AVEM-WE Willingness to work to exhaustion, AVEM-SP Striving for perfection, GSE General Self-Efficacy, TSE Teacher Self-Efficacy,* EC-AE awareness of emotion, EC-CE clarity of emotion, EC-FS felt sense of emotion, EC-AR ability to regulate emotion

*Statistically significant differences between groups at pre-test (p<.05).

Paired *t*-Tests for within group differences, significant changes (p<.05) in bold marks Cohen's d computed comparing change scores of treatment and control using pooled standard deviation. Directions of Cohen's d were modified so that larger positive ds indicate superiority of the intervention group over the control group, d>0,20 = small effect; d>0,50 medium effect, d> 0,80=large effect

Table 4: Effectiveness of MBSR at follow-up

Teacher Strain and Self-Regulation Measure	MBSR Pre M *(SD)*	Follow-Up M *(SD)*	t_{17}	*p*	Control Pre M *(SD)*	Follow-Up M *(SD)*	t_{13}	*p*	Cohen's *d* *d*
GHQ 12	4.94 (3.54)	2.35 (2.76)	**-3.56**	.003	3.62 (3.04)	3.46 (3.76)	-0.14	.89	0.70
KI	6.83 (1.69)	5.50 (1.38)	**-4.41**	<.001	5.77 (1.83)	6.15 (1.21)	0.96	.36	1.26
EI	6.00* (1.46)	4.83 (1.76)	**-4.12**	.001	4.69* (1.55)	5.31 (1.44)	**2.55**	.03	1.72
AVEM-SR	5.47 (2.24)	6.41 (1.77)	**2.70**	.02	6.17 (2.44)	5.58 (2.39)	-1.63	.13	1.14
AVEM-TR	7.33* (1.94)	5.67 (2.17)	**-4.40**	<.001	5.17* (2.25)	5.42 (2.39)	0.64	.54	-1.29
AVEM-PP	3.19 (2.11)	3.06 (1.57)	-0.28	.79	3.31 (1.70)	3.38 (1.81)	0.19	.86	-0.12
AVEM-IC	2.94* (1.18)	4.25 (1.48)	**3.16**	.01	4.31* (1.55)	4.38 (1.90)	0.25	.81	0.89
AVEM-IW	3.71 (2.05)	2.88 (1.65)	-1.51	.15	5.08 (1.75)	4.23 (2.05)	-1.94	.08	0.01
AVEM-WA	4.72 (2.02)	4.89 (2.08)	0.48	.64	4.85 (2.23)	5.62 (1.61)	**2.38**	.04	-0.45
AVEM-WE	5.00 (2.21)	4.12 (1.73)	**-2.43**	.03	4.62 (2.69)	5.23 (2.62)	1.76	.10	-1.19
AVEM-SP	4.29 (2.57)	3.35 (2.03)	**-3.11**	.007	4.54 (2.54)	4.38 (2.47)	-0.52	.61	-0.74
GSE	2.55 (0.40)	2.78 (0.38)	**2.93**	.01	2.75 (0.43)	2.76 (0.46)	0.11	.91	0.78
TSE	2.66 (0.43)	2.92 (0.37)	**3.30**	.004	2.96 (0.48)	2.94 (0.43)	-0.14	.89	0.74
EC-AE	3.47 (0.74)	3.74 (0.53)	1.46	.17	3.33 (0.85)	3.46 (0.66)	0.54	.60	0.18
EC-CE	3.46* (0.47)	3.81 (0.60)	**2.51**	.02	3.89* (0.61)	3.89 (0.73)	0.00	1.00	0.62
EC-FS	3.38 (0.86)	3.81 (0.82)	**2.37**	.03	3.50 (0.67)	3.42 (0.55)	-0.46	.65	0.77
EC-AR	2.65 (0.75)	3.35 (0.81)	**3.33**	.005	2.92 (0.63)	3.05 (0.96)	0.50	.62	0.66
EMO-DEPRI	2.51 (0.77)	1.96 (0.73)	**-3.40**	.004	2.05 (0.80)	2.18 (0.98)	0.57	.58	-0.92
EMO-ANGST	3.18 (0.57)	2.61 (0.72)	**-2.94**	.01	2.79 (0.75)	2.54 (0.91)	-1.15	.27	-0.39
EMO-STRESS	3.76 (0.70)	2.78 (0.77)	**-3.83**	.002	3.33 (0.77)	3.23 (0.85)	-0,47	.65	-0.99
EMO-COPING	3.12 (0.62)	3.36 (0.65)	1.43	.17	3.36 (0.65)	3.24 (0.79)	-0,67	.52	0.53
EMO-POS	2.80 (0.55)	3.28 (0.69)	**2.74**	.01	3.28 (0.59)	3.25 (0.83)	-0,16	.88	0.72

*Statistically significant differences between groups at pre-test (p<.05).

Paired *t*-Tests for within group differences, significant changes (*p*<.05) in bold marks Cohen's d computed comparing change scores of treatment and control using pooled standard deviation. Directions of Cohen's d were modified so that larger positive ds indicate superiority of the intervention group over the control group, *d*>0,20 = small effect; *d*>0,50 medium effect, *d*> 0,80=large effect

At post-test, intervention group participants reported statistically significant reductions in cognitive and emotional strain. Control group teachers reported increases in these measures that missed statistical significance. Between group effect sizes were large. *t*-tests revealed that self-regulation competences improved in the intervention group. Teachers of that group reported an increased, but not statistically significant, ability to switch off from work problems at home, while teachers of the control group reported decreases at the same time. Therefore, a medium effect size between groups was detectable. Teachers of the intervention group reported statistically significant improvements in the tendency to resign and the ability to find inner calm and balance while non-significant changes were observed in the control group. Between-group effect sizes were large for the reduced resignation and small for increased inner calm. Both groups reported non-significant changes in their ability to proactively solve problems. Changes in teacher engagement yielded surprising results. Teachers in the intervention group reported decreases in professional engagement in all four scales with two of them reaching statistical significance. At post-test, the willingness to work to exhaustion decreased statistically significantly in the intervention group, while it increased at the same time in the control group. Teachers in the intervention group also reported striving less for perfection in their work – while the teachers in the control group did not report significant changes. There was a small between-group effect size. Both general and teacher self-efficacy improved statistically significantly in the intervention group while no changes in general self-efficacy and a slight reduction of teacher self-efficacy were reported in the control group. Between-group effect sizes were high for teacher efficacy and medium for general efficacy. Similarly, teachers of the intervention group reported large improvements in their emotional competence that yielded medium to large between group effects. Negative emotions decreased in both groups. However, only the decrease in the intervention group reached statistical significance. Fear and stress emotions also decreased significantly in the intervention group. Between-group effect sizes for negative emotions were small for depression, medium for fear, and large for stress emotions. Both groups showed increases in positive emotions at post-test. However, intervention group participants showed greater improvements that reached statistical significance. Between group effect sizes were small for coping emotions and large for other positive emotions.

The 3-month follow-up measures took place right before mid-term – which is usually described as a particularly stressful working period. However, most improvements in the experimental group were sustained or increased. For example, teachers in the intervention group reported greater improvements in the ability to stop ruminating about work problems at home. At the same time, the control group reported being less able to switch off. Between group effect sizes were high. Similarly, teachers of the intervention group reported greater decreases in emotional irritation – a measure of teacher irritability – while teachers of the control group found themselves more irritable. Between-group effect sizes were high. However, the control group reported greater increases in work-related ambition that reached statistical significance while the increases in the experimental group did not. There was a small effect in favour of the control group. Intervention group teachers reported greater decreases in negative emotions such as fear, while control group teachers found their negative emotions on the rise. At the same time, control group teachers reported experiencing less positive emotions, while the intervention group teachers reported greater increases in positive emotions at follow-up. Between-group effect size was medium.

Mediation Analysis of Intervention Effects

Our fourth question investigated whether group differences in mindfulness at post-test mediated the training impact on self-regulation ability at 3-month follow-up. We looked at two mediation models:

1) Experimental condition (predictor) → Changes in mindful presence at post test (mediator) → Changes in self-regulation at follow-up (outcome)
2) Experimental condition → Changes in mindful acceptance at post test → Changes in self-regulation at follow-up

We applied a standard two-step mediation procedure (Bühner & Ziegler, 2009). First, we checked if the predictor (group dummy coded: 1=intervention, 0=control) and the change score of at least one of mediators, the mindfulness subscales mindful awareness and mindful acceptance, at post-test, and outcome correlated significantly with each other ($p<.05$). Eight outcome variables (ability to stop ruminating, tendency to resign, ability to remain calm, readiness to work hard, self-efficacy, teacher-efficacy, depressiveness, stress emotions) fulfilled the first assumption and thus the condition of conducting a mediator analysis. In the second step, we regressed the outcome on predictor and mediator. A full mediation can be assumed, when the mediator, but not the predictor explains the model statistically significantly. Of the eight qualifying outcome variables, six were fully mediated by changes in one or both mindfulness scales at post-test (table 5). Table 5 shows a summary of all mediation models. Figure 2 depicts a mediation model for the ability to stop ruminating.

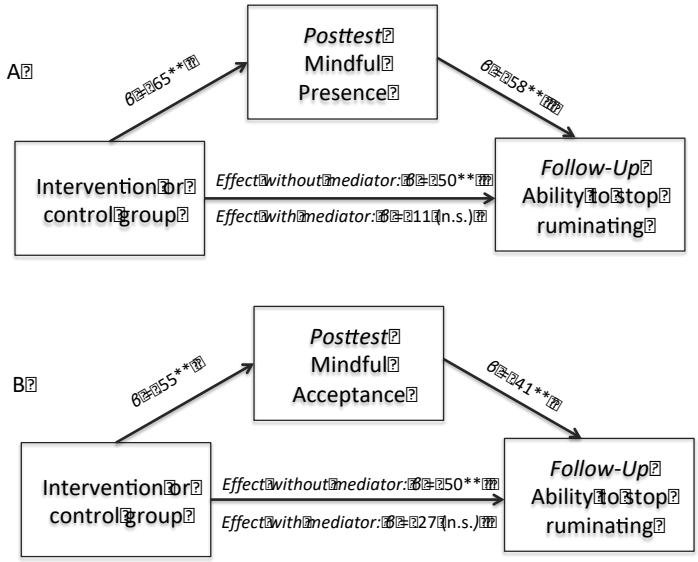

Figure 2: Mediation analyses: Group differences in teacher mindfulness post-program due to intervention mediate reductions in the ability to stop ruminating at 3-month follow-up.

*A: Test for mediated effect of mindfulness training on teachers' ability to stop ruminating at follow-up through teachers' mindful acceptance at post-program . The indirect effect accounted for 38% of the variance (adjusted r^2, F (2.25 = 9.55**) in the ability to stop ruminating at follow-up. n.s,= nonsignificant, *p<=.05. **p <= .01.*

*B: Test for mediated effect of MT on teachers' ability to stop ruminating at follow-up through teachers' mindful presence at post-test. The indirect effect accounted for 31% of the variance (adjusted r^2, F (2.25 = 7.00**) in the ability to stop ruminating at follow-up. n.s,= nonsignificant, n = 28 *p<=.05. **p <= .01.*

Table 5: Summary of linear regression models

Outcome Variable	Predictor Mediator	*β* standardised	*df*	*F* Model	r^2 adjusted Model
AVEM-SR	Condition	.11	2,25	9,55**	.38
	FMI-P	.58**			
	Condition	.27	2,25	7,00**	.31
	FMI-A	.41*			
AVEM-TR	Condition	-.16	2,26	13,50***	.47
	FMI-P	-.59**			
	Condition	-.33	2,26	10,65***	.41
	FMI-A	-.44*			
AVEM-IC	Condition	.21	2,26	3,48*	.15
	FMI-P	.30			
	Condition	.17	2,26	5,10*	.23
	FMI-A	.42*			
AVEM-WE	Condition	-.44	2,26	5,01*	.22
	FMI-P	-.13			
	Condition	-.41	2,26	5,46*	.24
	FMI-A	-.20			
GSE	Condition	.04	2,26	4,10*	.18
	FMI-P	.46*			
TSE	Condition	.17	2,27	3,84*	.16
	FMI-P	.35			
EMO-DEPRI	Condition	-.24	2,26	3,54*	.15
	FMI-P	-.28			
	Condition	-.17	2,26	5,67**	.25
	FMI-A	-.44*			
EMO-Stress	Condition	-,12	2,24	8,30**	.36
	FMI-P	-.55*			
	Condition	-.23	2,24	8,08**	.35
	FMI-A	-.48*			

Scales: *AVEM SR Ability to stop ruminating, AVEM-TR Tendency to resignation (in the face of failure), AVEM IC Inner calm and balance, AVEM-WE Willingness to work to exhaustion, GSE General Self-Efficacy, TSE Teacher Self-Efficacy,* Emo-Depri – negative affect, depressive emotion, Emo Stress – negative affect, stress emotion. Condition dummy-coded: 1=mindfulness group, 0=waitlist control group, FMI-P Freiburg Mindfulness Inventory, Mindful presence, FMI-A Freiburg Mindful Inventory, Mindful acceptance.
Linear regression model of changes in outcome variables at follow-up on condition (predictor) and changes in mindfulness subscales at post-test (mediator), $p<.05$, ** $p<.01$, *** $p<.001$

Qualitative Interviews with Teachers Regarding their Professional Performance

Our final research question focused on teachers' narratives about the changes they had observed in their professional performance, illustrated by a specific example. Interviewees were prompted to share their experiences until they couldn't think of any more. The main author coded the quotes and grouped them into themes following thematic analysis procedure.

Wiser engagement: Teachers reported engaging more wisely in work demands, terminating activities that cause stress while finding more space to teach creatively. For example, a primary school teachers said: "I improved in setting boundaries and delegating tasks. It's easier for me to say: 'This is my responsibility and this is not'." On a similar note, a secondary school teacher observed "I am more aware of strain and better able to say 'stop, I can't do more.'." At the same time, teachers felt more engaged. A secondary school teacher, said "Due to an increased inner calm and energy, I felt I was able to teach my classes in a more interesting way. I felt more motivated." A primary teacher, was more relaxed even during stressful times like Christmas. She prepared a theatre play with students and was surprised that "it somehow felt easier to do – maybe because of a changed attitude, I was less judgemental of myself and the students, I felt more efficient and just had more fun!"

Greater self-efficacy: Teachers were more confident in coping with difficult students and effectively dealing with professional demands. A secondary school teacher, observed that "when I stay calm in the interaction with the students, they are calmer as well." Another teacher noticed that it's not so much her methods but rather her presence that predicts a successful class outcome. She summarized that "No matter what I do, as long as I am present, everything

somehow works out – I have also experienced bad times before, where nothing worked out at all and I didn't know why."

Better emotion regulation: Teachers developed more skills in coping with negative emotions in the classroom, namely accepting negative emotions and embodying emotions. An elementary school teacher was able to pause and stop herself reacting in an unhelpful way: "When it is so loud in the classroom that I notice the urge to scream so everybody calms down, I was now able to pause and remember that this is not the right way of doing it." Another teacher described that taking a couple of deep breaths helped when struggling with a similar challenge. She also realised that "being compassionate" with herself supported her terminate ruminating about emotionally charged situations. "I am better able to accept a challenging situation – like being confronted by a parent – and let go of it, rather than walking around with it for a couple of days, sleeping poorly and talking to everybody about it." Another teacher noted that she can let go tense situations faster "Even though I left one classroom tensely I was able to enter the next with half a smile. I learned not to drag the annoyance about any old disturbance in one classroom into the next. It is so helpful to be able to return to the present moment." One teacher explains: "I gained more self-confidence just by having a greater awareness of my body. It's not that I am doing a specific exercise, I just feel I can take more space and I am generally more present with my body in the classroom. It's just a small change but it means a lot to me."

Greater resilience: Teachers were using mindfulness practices to switch off from work stressors, to regain energy during lunch breaks, to be able to work more effectively on activities demanding endured attention like grading exams. Additionally, some of them felt they were given a tool that helps them in the face of difficulties and that they can resort to when needed. For example, one teacher described an increased ability to cope with difficulties "I am now able to notice 'This is very hectic'. And then I tend to not take things so personal anymore. I take a deeper breath and regulate myself with a greater inner distance to the physical reaction." One teacher found it "a great new freedom to be able to step out of situation and look at it from a greater distance. I am not a slave of my habitual patterns anymore."

Discussion

To our knowledge, this study is the first to investigate whether Mindfulness-based Stress Reduction (MBSR) enhances teachers' self-regulation ability and classroom performance. Participants complied with home practice, practicing on average about 80% of the practice days. Furthermore, the satisfaction with the MBSR intervention was high; 82 % of the teachers would recommend it to colleagues. MBSR seems to be promising to improve mindfulness and most self-regulation abilities in a self-selected sample of teachers. Teachers improved significantly on measures of stress and health, coping abilities, emotion regulation, and self-efficacy from the intervention. Additionally, the training effects stabilized or improved at the 3-months follow up. We observed medium to large between-group effect sizes. This is in line with other trials that showed mindfulness training decreased teachers' stress symptoms (Flook, Goldberg, Pinger, Bonus, & Davidson, 2013; Roeser, Skinner, Beers, & Jennings, 2012).

However, we also found that measures of teacher engagement decreased significantly in the intervention group compared to the control group and that these effects were sustained at the 3-months follow up. Qualitative data highlighted a more complex view on the decreased teacher engagement. Teachers explained that they became more aware of stressors and in turn, engaged more wisely with work demands: Deciding where effort is needed most and retreating from unnecessary additional tasks. The findings suggested a more empowered employee that takes better care of their resources which is at the core of self-regulation as a professional competence. However, more research is needed to investigate the impact of mindfulness on work engagement.

Changes in mindfulness at post-test fully mediated changes in self-regulation at 3-month follow-up. This indicates that increased mindfulness led to these changes. Interestingly, mindfulness did not account for the changes in work engagement. Roeser and colleagues (2012) were also able to show that mindfulness levels at post-test mediated teacher stress and self-compassion at follow-up. However, they used a different instrument to assess mindfulness.

The consistency of the results within the quantitative domains of measurement and confirmation by qualitative data are encouraging and build the basis for further implementation of such mindfulness trainings as a potential instrument for teacher training, at least for those teachers that find such a training appealing.

Limitations of this first pilot study should be borne in mind: The sample was self-selected and mostly female teachers were interested in participating in the study. Even though there is a higher ratio of females in the education sector, the actual percentage of women is lower with 68.7 percent across all school types (Statistisches Bundesamt, 2017). The small sample size and the non-randomized design limit generalisability of results. Since this is the first pilot-testing of

MBSR in a professional teacher setting in Germany, a randomized follow-up study is required before our results can be considered confirmed.

Future studies should also use more objective outcome measures, such as observer-rated teaching performance or student feedback could, to assess the general performance of teachers in addition to self-report data. This is especially warranted given that teacher wellbeing is linked to classroom performance and the self-assessment of teaching performance of teachers hardly overlaps with more objective assessments by students and classroom observers (Clausen, 2002).

Despite these limitations we are confident to summarise that a mindfulness training of teachers together with diligent home practice of mindfulness can help teachers to improve their self-regulation capacity, their well-being and their self-efficacy. A deeper investigation of this potential is warranted.

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