Mindfulness-based stress reduction for elementary school teachers: a randomized controlled trial

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Educators frequently grapple with elevated levels of job-related stress, heightening the risk of mental health issues. Although Mindfulness-Based Stress Reduction (MBSR) has demonstrated effectiveness in reducing stress among the general populace, its implementation among educators, especially in non-United States settings, has received limited exploration. This pre-registered randomized-controlled trial investigates the effectiveness of the standard MBSR in reducing perceived stress among Dutch elementary school teachers. Additionally, it examines the impact of MBSR on mindfulness skills, emotion regulation, and self-compassion as secondary proximal outcomes, along with exploring its influence on teacher self-efficacy, perceived pupil-teacher relationships, and classroom climate quality as secondary distal outcomes. Involving 146 teachers randomly assigned to either the intervention ($n = 72$) or waitlist-control condition ($n = 74$), assessments were conducted pre- and post-intervention or control period, with a 3-month follow-up. Participants in the intervention reported significantly lower perceived stress compared to the control group, demonstrating a substantial effect size at post-treatment ($d = -0.84$) and a moderate effect at follow-up ($d = -0.69$). MBSR not only yielded improvements in personal well-being but also positively impacted teacher self-efficacy and classroom climate quality at both post-treatment and follow-up. These positive outcomes aligned with enhancements in mindfulness skills, emotion regulation, and self-compassion. However, no significant effects were observed on the pupil-teacher relationship. Exploratory analyses revealed no moderation effects based on past or present psychological problems, school weight/pupil population, years of experience, or age on perceived stress at post-measurement. Furthermore, the study examined the potential influence of COVID-19 on the results, concluding that the pandemic had no discernible impact. These findings advocate for the widespread adoption of the standard MBSR program as a means of enhancing the well-being of elementary school teachers.

KEYWORDS

mindfulness, elementary school teachers, perceived stress, mental health, emotion regulation, teacher self-efficacy, pupil-teacher relationship, classroom climate quality

1 Introduction

Being a teacher is widely acknowledged as one of the most demanding professions (Lomas et al., 2017). This holds particularly true for elementary school teachers in the Netherlands, who report higher levels of burnout symptoms and increasing absenteeism compared to other professions (Statistics Netherlands, 2022). One in five elementary school teachers exits the educational system within 5 years (Ministry of Education, Culture and Science, 2022), with one in eight leaving due to reasons such as sickness, disability, or retirement (Statistics Netherlands, 2018). Elementary school teachers, interacting with their pupils on a daily basis, experience a stronger emotional involvement in teaching and cultivate stronger pupil-teacher relationships compared to teachers in secondary or higher education (Statistics Netherlands, 2020). Therefore, elementary school teachers may experience more profound effects from a stress reduction intervention. These benefits may manifest in various aspects, such as improved quality of pupil-teacher relationships and classroom climate, factors closely linked to teachers' perceived stress (Collie et al., 2017; Jennings et al., 2017; Lomas et al., 2017; Corbin et al., 2019). Moreover, there is a notable scarcity of research on interventions addressing stress among elementary school teachers (Jennings et al., 2017). A limited number of randomized controlled trials (RCTs), infrequent preregistration of study protocols, and rare follow-up assessments characterize the current state of research in this context. In response to this concerning trend, the current preregistered randomized-controlled trial aims to assess the effectiveness of the standard Mindfulness-Based Stress Reduction (MBSR) program on the perceived stress levels (primary outcome) of Dutch elementary school teachers. This research endeavors to address the following key inquiries: (1) Does participation in the standard MBSR training lead to a decrease in perceived stress and an enhancement in well-being among elementary school teachers? (2) To what degree do mindfulness skills, emotion regulation, and self-compassion serve as secondary proximal outcomes in the context of MBSR training? (3) To what degree do teacher self-efficacy and their perceived pupil-teacher relationship and classroom climate quality serve as secondary distal outcomes in the context of MBSR training? and (4) Are the effects of the MBSR training moderated by factors such as past or present psychological problems, school weight, years of teaching experience, and age?

2 Theoretical background

2.1 Effects of stress on teachers

Increased perceived stress is associated with diminished emotional, psychological, and social well-being, along with lower performance (de Carvalho et al., 2021). It also negatively impacts teacher self-efficacy, influencing instructional practices, adaptability, and classroom climate quality (Emerson et al., 2017; Lomas et al., 2017; McIntyre et al., 2017). Teacher self-efficacy refers to teachers' beliefs and attitudes about their ability to enhance pupils' learning outcomes (Tschannen-Moran and Woolfolk Hoy, 2001). Higher self-efficacy correlates with improved effectiveness, positive student outcomes, and better classroom climate quality (Chong and Kong, 2012; Robertson and Dunsmuir, 2013; Meristo and Eisenschmidt,

2014). Conversely, lower self-efficacy relates to increased stress and decreased commitment to teaching (Klassen and Chiu, 2011).

Furthermore, teachers' perceived stress has the potential to shape pupil-teacher interactions, constituting an integral aspect of teachers' perceived classroom climate quality. This encompasses not only the general atmosphere and environment within a classroom setting but also extends to factors such as classroom order, the quality of interpersonal relationships among pupils, and the nature of pupil-teacher interactions (Donkers and Vermulst, 2014, p. 9). Poor pupil-teacher relationships and a negative classroom climate quality directly and indirectly affect teachers' perceived stress and well-being (Collie et al., 2017; Jennings et al., 2017; Lomas et al., 2017). On the other hand, research by Corbin et al. (2019) shows that positive pupil-teacher relationships may help mitigate the stress they experience.

2.2 Reducing teachers' stress

Stress arises from interpreting stressors and regulating emotions (Lazarus, 1991); suggesting interventions should target emotion regulation, defined as the activation of a goal to influence the emotion trajectory (Gross et al., 2011). Research indicates that mindfulness increases emotional self-regulation (Hölzel et al., 2011; Vago and Silbersweig, 2012; Tang et al., 2015), which has also been supported by research in neuroscience (Hölzel et al., 2011; Tang et al., 2015). Mindfulness-Based Stress Reduction (MBSR), characterized as "the awareness that arises through purposeful, nonjudgmental attention to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p.145), stands out as a promising intervention to mitigate perceived stress and enhance well-being through the refinement of emotion regulation.

2.3 Theory of change

The core of MBSR involves cultivating mindfulness skills, allowing participants to direct their attention to the present moment through the development of an observing stance toward their thoughts, feelings, and behaviors. This practice improves the capacity to identify habitual reaction patterns, empowering individuals to make conscious choices. Participants develop the ability to respond with reduced reactivity to negative thoughts and emotions (Gilbert and Waltz, 2010; Fanning et al., 2018; Rad et al., 2023). Additionally, the overall fostering attitude of self-compassion in MBSR, which can be defined as the practice of providing oneself with support in times of suffering or pain, helps in developing empathy, understanding, and kindness toward oneself and others (Kristin et al., 2018; Neff, 2023). Empirical literature strongly supports the idea that self-compassion acts as a buffer against the negative effects of stress on well-being (Zessin et al., 2015; Neff et al., 2018; Phillips and Hine, 2021).

In summary, the intervention is anticipated to enhance teachers' mindfulness skills (Jennings et al., 2017) and foster self-compassion (Roeser et al., 2022). This, in turn, is expected to promote improved emotion regulation (Tang et al., 2015; Jennings et al., 2017; Roeser et al., 2022), leading to a reduction in perceived stress and an increase in emotional, psychological, and social well-being (Jennings et al., 2017; Querstret et al., 2020; Roeser et al., 2022). Regarding teacher skills, past MBSR interventions among teachers have demonstrated an

increase in teachers' self-efficacy (Emerson et al., 2017). This enhanced self-efficacy, facilitated by the fostering attitude of self-compassion, is anticipated to contribute to improved pupil-teacher relationships and a higher classroom climate quality (Chong and Kong, 2012; Robertson and Dunsmuir, 2013; Meristo and Eisenschmidt, 2014). For a visual representation of the theory of change, please refer to Figure 1.

2.4 Mindfulness-based interventions for teachers

Over the past 2 decades, research on Mindfulness-Based Interventions (MBIs) for teachers has steadily grown. However, there is a notable scarcity of studies specifically addressing elementary school teachers. Furthermore, RCTs are relatively few, preregistration of study protocols is uncommon, and follow-up assessments are rare. The existing research on MBIs in education is predominantly conducted within the United States for pupils aged 5–18, differing from European educational systems where elementary school teachers primarily instruct children aged 4–12 (Emerson et al., 2017; Hwang et al., 2017; Klingbeil and Renshaw, 2018; Zarate et al., 2019). Unlike teachers in secondary or higher education, elementary school teachers typically maintain a consistent group of pupils for 5 days a week, fostering a stronger teacher-pupil relationship and heightened emotional involvement in teaching (Statistics Netherlands, 2020). Given these distinctions, a reasonable hypothesis is that MBIs may exhibit more pronounced effects in elementary schools. Moreover, the majority of studies investigating mindfulness for teachers focus on MBIs specifically tailored to the educational context. Consequently, these interventions often deviate in terms of content and duration from the standard MBSR program. Numerous studies collectively suggest that these MBIs yielded positive effects. First, the meta-analysis of 29 studies by Klingbeil and Renshaw (2018) evaluated teacher interventions in which training mindfulness skills was the primary therapeutic component. This included standard or adapted versions of MBSR, but also programs such as Stress Management and Relaxation Techniques-in-education (SMART; Cullen and Wallace, 2010), Cultivating Awareness Resilience in Education (CARE;

Jennings et al., 2011), and Cultivating Emotional Balance Training (Kemeny et al., 2012). There was a large variety in duration (from 2 to 36 weeks) and dosage (from 2 to 75 h) of the MBIs. The impact on teachers' occupational stress and burnout ranged from small to medium, accompanied by enhancements in mindfulness skills and psychological well-being. A meta-analytic review of MBIs, including 18 manuscripts with a total of 1,001 in-service teachers (Zarate et al., 2019), has found similar findings.

Furthermore, MBIs contributed to a slight improvement in the quality of teachers' interactions with students and the overall classroom climate. Another systematic review (Hwang et al., 2017) including 16 intervention studies with a mixed teacher population on MBIs (e.g., CARE, adapted MBSR) showed large effects on perceived stress and mindfulness skills, medium effects on self-compassion, and small effects on teacher self-efficacy. In addition, from a systematic review and narrative synthesis (Emerson et al., 2017) on the effects of MBIs for K-12 teachers (e.g., SMART, CARE, adapted MBSR, Mindful Based Wellness Education; Poulin, 2009) it was concluded that MBIs resulted in improvements in mindfulness skills, emotion regulation and self-compassion. Consequently, these enhancements played a role in reducing stress levels among teachers and fostering an increase in teacher self-efficacy.

While these overview studies exhibit promising effects, it is essential to note that the majority of included studies were conducted in the United States and encompassed a diverse teacher population. Notably, a recent study by de Carvalho et al. (2021) examined the effects of MBIs specifically for elementary school teachers. This recent research, involving 228 Portuguese elementary school teachers, stands out as one of the few European RCTs, albeit without a longer-term follow-up. The intervention group reported a significant increase in well-being, mindfulness skills, emotional regulation, and self-efficacy. However, classroom observations revealed only short-term benefits for teachers' classroom climate quality. This study enriches existing literature by investigating the effects of a standard 8-week MBSR program on Dutch elementary school teachers. Our primary outcomes focus on mental health and include perceived stress and personal well-being, with secondary measures focusing on teacher self-efficacy, teacher-perceived

FIGURE 1
Theory of change.
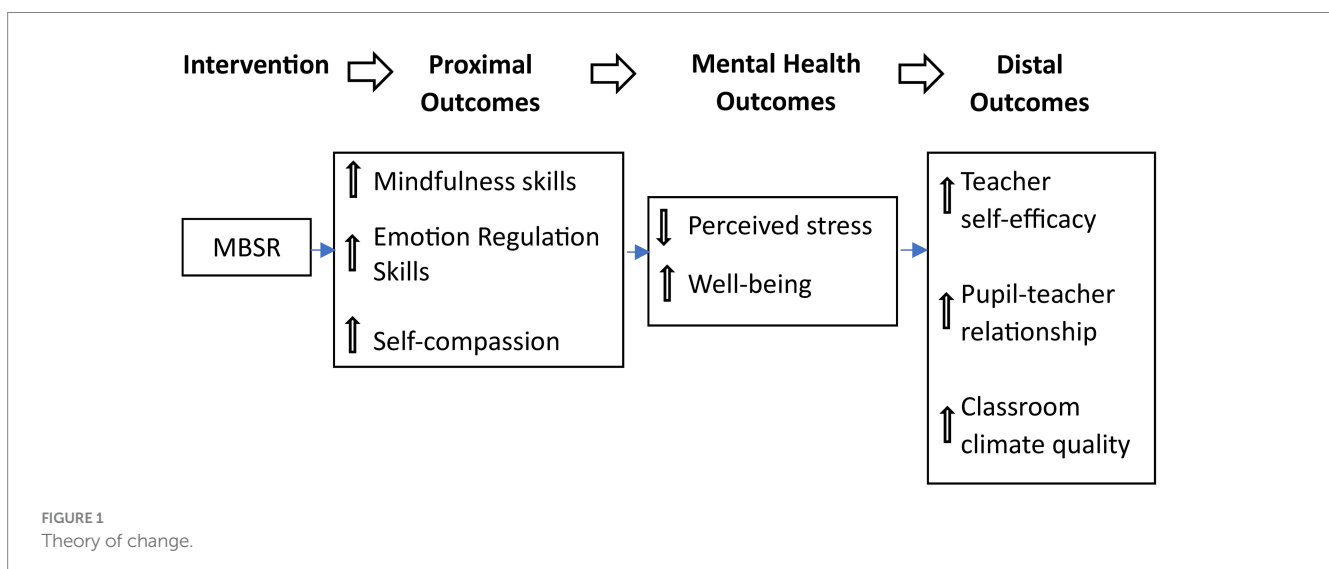
pupil-teacher relationships, and classroom climate quality. Employing a pre-registered RCT design with follow-up assessments and a substantial sample size, we also explore proximal outcomes such as mindfulness skills, emotion regulation, and self-compassion. Distinguishing itself from previous research (e.g., Emerson et al., 2017; Klingbeil and Renshaw, 2018; Roeser et al., 2022), this study utilizes a larger sample, extended follow-up, and evaluates the impact of mindfulness training on teachers at various career stages, in diverse school environments, and of different ages. To advance our understanding of program impacts, it is crucial to extend these studies to elementary and secondary school teachers worldwide, promoting a sustainable field marked by diverse replications.

2.5 Potential moderators

Elementary school teachers form a diverse cohort, prompting an exploration of potential moderators influencing the impact of the MBSR program. The preliminary pilot, conducted prior to this RCT (Lensen et al., 2022), indicated a potential magnified effect of MBSR on teachers who have or had psychological challenges, especially those working in schools with pupils facing a higher risk of educational disadvantage, as quantified by school weight in the present study. In the Netherlands, school weight is a government metric objectively assessing the complexity of the educational environment. It assigns significance to specific student characteristics, ensuring additional funds for schools to support high-risk pupils and address educational inequalities (Statistics Netherlands, 2019). In addition, a recent study (Roeser et al., 2022) revealed that an adapted MBI for teachers (grade 6–8) had more positive outcomes for newer teachers (experience <5 years) in terms of job stress, self-compassion, and classroom organization compared to experienced teachers. Moyano et al. (2021) observed that greater teaching experience was associated with increased reliance on automatic pilot mode, leading to reduced focus. Additionally, Huang et al. (2020) noted that as teaching experience increased, empathic concern decreased, perspective taking diminished, and personal distress increased. Although age was often unrelated in previous research (e.g., de Carvalho et al., 2021; Moyano et al., 2021) we included it due to an increasing number of lateral entries in the primary education sector in response to the teacher shortage. These teachers, though older, have accumulated fewer years of work experience in education compared to their younger colleagues potentially resulting in distinct experiences and lessons derived from the intervention.

2.6 Hypotheses

Drawing upon insights from prior research (e.g., Tang et al., 2015; Emerson et al., 2017; Hwang et al., 2017; Klingbeil and Renshaw, 2018; Roeser et al., 2022), our hypothesis posits that elementary school teachers participating in the MBSR program will exhibit enhanced mental health. This enhancement is substantiated by anticipated reductions in stress (primary outcome) and improvements in personal well-being (secondary outcome), as compared to teachers in the waiting list control group, evident in both post-test and three-month follow-up assessments. Moreover, we anticipate positive developments in various secondary outcomes,

categorized as proximal and distal. Proximal outcomes denote personal-level achievements that may be realized during, directly after, or shortly following the intervention, potentially serving as working mechanisms in enhancing mental health outcomes related to stress and well-being. Distal outcomes, on the other hand, represent effects of the MBSR program observable in the teaching environment, which may require a longer duration for observation. Specifically, we expect the MBSR program to yield improvements in proximal outcomes such as mindfulness skills, emotion regulation, and self-compassion. Concurrently, we anticipate positive developments in distal outcomes, encompassing teacher self-efficacy, perceived pupil-teacher relationships, and the overall quality of the classroom climate as distal (secondary) outcomes. This multifaceted approach allows for a comprehensive evaluation of the MBSR program's impact, both on the personal well-being of participating teachers and the broader teaching environment.

3 Materials and methods

3.1 Study design

This study employed a RCT to assess the efficacy of MBSR compared to a waiting list control condition in alleviating perceived stress among elementary school teachers. The stratified random sampling was conducted at an individual level, taking into account factors such as school weight and gender. Assessments took place before and after the MBSR program or waiting list period (September and November), and at 3 months follow-up (March, within the same school year). Teachers in the control group were offered to participate in MBSR after the follow-up assessment within the same school year. Recruitment took place in a large urban area in the Netherlands, in three consecutive school years: 2019–2020, 2020–2021, and 2021–2022. See Figure 2 for an overview of the study design. In the first school year, recruitment of teachers took place between June and late August 2019 ($n=41$ teachers), in the second between March and August 2020 ($n=50$ teachers) and in the last between March and August 2022 ($n=55$ teachers). It is important to notice that the COVID-19 pandemic started in March 2020, between school year 1 and 2. The study protocol was ethically approved by the Internal Review Board (IRB) of the faculty of social sciences Radboud University and is registered under number ECSW-2019-029. The protocol details are available in a publication by Lensen et al. (2021).

3.2 Participants

The study population consisted of 146 Dutch elementary school teachers from 62 different public elementary schools who taught groups 1–8, comparable to grades 1–6 in the United States school system. Of the 152 teachers who had registered to participate, six teachers did not meet the inclusion criteria. See Figure 3 for an overview of the Consort flow diagram. Inclusion criteria were: (a) teaching at least 2 days a week in the same year group (1–8), during a school year between September and March (moment of follow-up); (b) willing and able to fill out questionnaires in Dutch three times during a school year; and (c) being able to start MBSR in both September and March. Exclusion criteria were previous

FIGURE 2
Study design.
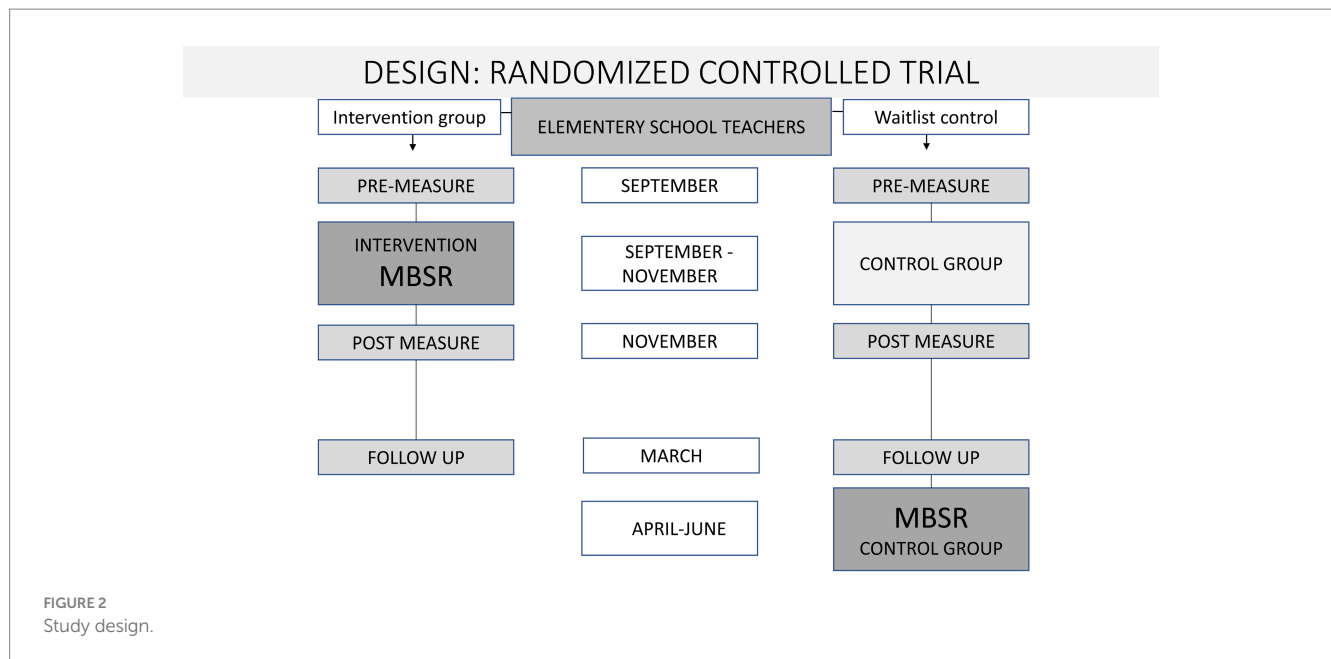
participation in a MBI or a mindfulness-based workshop lasting more than 3 h.

3.3 Stratified random sampling

Stratified random sampling at individual level was performed after completion of the informed consent forms using Castor Electronic Data Capture system (Castor EDC, 2019). It was independently carried out by a team member, SS, using a stratified blocked random sampling scheme (block size 4) and stratified by: (a) gender (male vs. female) and (b) school weight of the school the teacher was employed by. We stratified by gender because female teachers experience more stress than their male colleagues (Li et al., 2020; Ozamiz-Etxebarria et al., 2020). School weight is a government measure used in the Dutch education system to give weight to characteristics of a pupil associated with a higher risk of educational disadvantage (Statistics Netherlands, 2019; https://www.cbs.nl/en-gb). Each pupil is assigned a specific "weight." For every school, the weighted number of pupils is calculated by multiplying the total number of pupils by their respective individual weights. This results in the overall school weight. Depending on stratified random sampling, teachers who were included in the study were allocated to start MBSR either in September (intervention condition) or in March (wait-list control condition) of a particular school year. As the study involved a psychological intervention that teachers actively engaged in, maintaining participant blinding to their assigned condition was not feasible.

3.4 Procedure and allocation

To recruit participants, information about MBSR and the research study was disseminated to school boards in the study area and they were asked to bring it to the attention of their teachers. Teachers were also recruited by social media and during presentations at schools.

Teachers who were interested in participating were asked to contact the study team by email, telephone, or they could use an online login link. A member of the research team (JL) contacted each interested teacher for a screening interview by telephone. Details about the program were explained and teachers were able to ask questions. Next, it was determined whether the teacher met eligibility criteria. Teachers who were willing to participate provided written informed consent, after which they received an online questionnaire asking for their demographic characteristics. Other self-report questionnaires were sent to all teachers before (pre) and after MBSR or waiting list period (November) and at 3 months follow-up (March). All questionnaires were digitally sent and processed anonymously by Castor EDC, which tracked and logged any manual changes made to the raw data. After 5 days, participants who had not completed the questionnaires were reminded by email. If no response followed, they were contacted per telephone to motivate them to complete the questionnaires. During each school year, the intervention training was taught "live" three times a week between September and November at a centrally located training facility within the region. When registering, participants were given the option to prioritize their preferred training session time (e.g., afternoon, evening), aiming to encourage research participation. These groups were supplemented by diverse participants from elementary schools (e.g., teachers, principals, staff members, and school administrators) from the region who registered for the standard MBSR program but did not participate in the study. Group sizes ranged from a minimum of 6 to a maximum of 15 participants. Participants were not paid for providing data and completing the intervention. Costs for participating in the course were covered by their school boards.

Although the protocol paper for this study (Lensen et al., 2021) referred to data collection for the outcome measure "teacher absenteeism," due to the COVID-19 pandemic we had to drop this outcome measure. The regular absence of teachers for a variety of COVID-19 related reasons would have biased this outcome measure. In contrast to our original plans, we opted not to incorporate pupil

CONSORT Flow Diagram

FIGURE 3
Consort flow diagram.
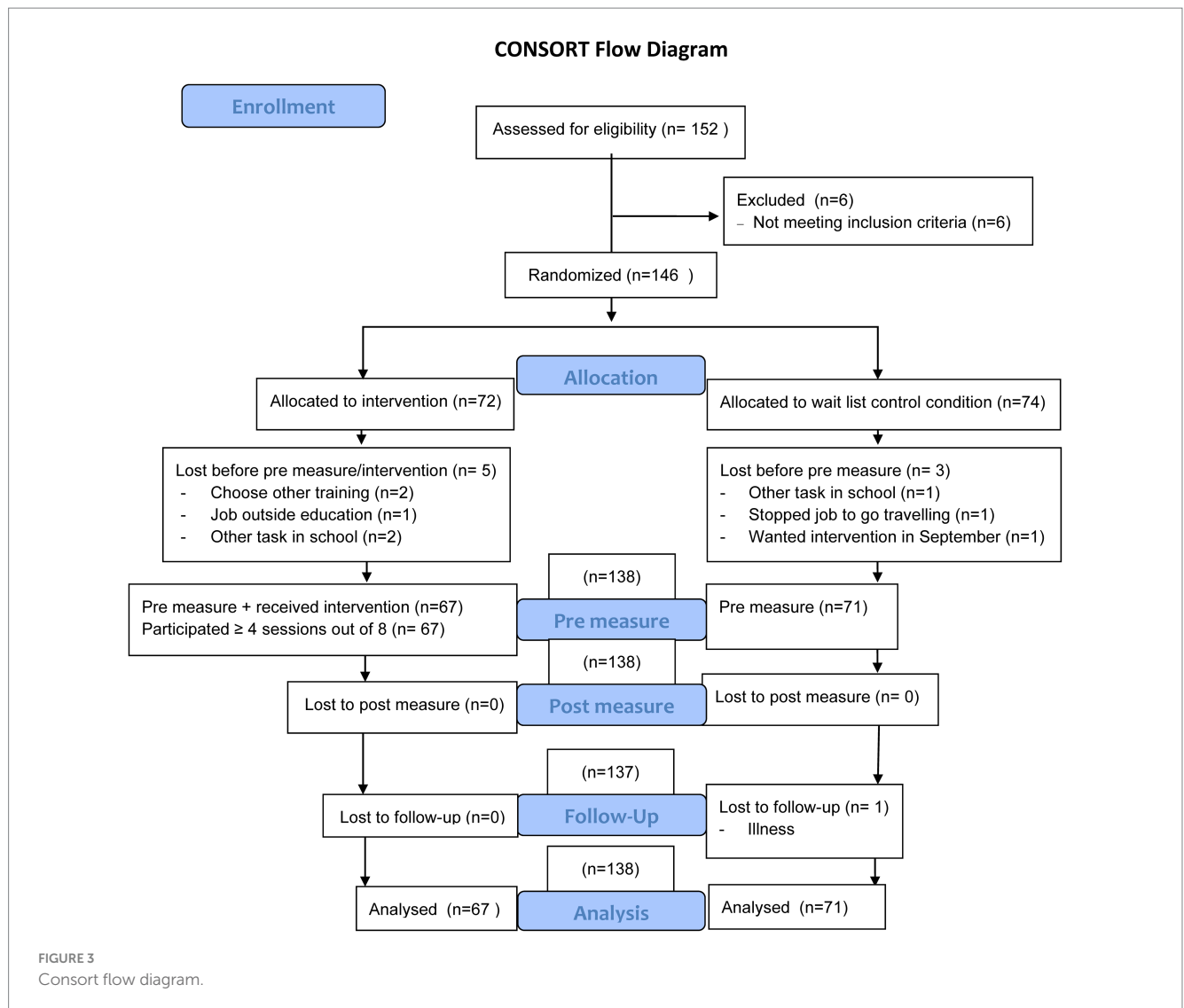
perspectives on pupil-teacher relationships and classroom climate quality due to insufficient parental consent. Despite our concerted efforts, response from parents was limited, especially in schools with a higher school weight.

3.5 Intervention

The intervention consisted of the original MBSR-program developed by Kabat-Zinn (2013) containing eight weekly group sessions (6–15 participants) with a duration of 120 min each. The training consists of three primary components: (1) formal and informal meditation exercises, such as sitting meditation and yoga; (2) dialogue; and (3) psychoeducation about stress and stress responses. A folder was provided with information about each weeks' session and participants were asked to practice daily for at least 35 min. The study did not assess the amount of practice outside the sessions. Initially, MBSR was primarily offered in a face-to-face format. However, due to COVID-19, for school year 2020–2021 the last four sessions had to be conducted online. In the 6th week, an additional day of silent practice was included. Due to COVID-19 restrictions, this additional

session could not take place face-to-face and participants were encouraged to practice a day in silence at home using a protocol, which was provided by the trainer. For the face to face training in school years 2020–2021 and 2021–2022, additional measures were implemented, including increased spacing between participants and extra ventilation. The mindfulness teacher (JL) met the advanced criteria of the internationally agreed good practice guidelines of the United Kingdom Network and the Association of Mindfulness-Based Teachers in the Netherlands and Flanders (Crane et al., 2013). In addition, the trainer had supervision by a licensed MBSR supervisor once or twice during each MBSR program. As planned the number of sessions attended by each participant was noted and several sessions were recorded. A licensed psychologist was available during and after the program when the trainer or participants noted that they might be in need of additional mental support.

3.6 Measures

A detailed description of all questionnaires can be found in Lensen et al. (2021).

3.6.1 Primary outcome measure

3.6.1.1 Perceived stress

The main mental health outcome is perceived stress as measured by the Perceived Stress Scale (PSS, Cohen et al., 1983). The PSS is a self-report questionnaire to measure teachers' global stress levels in the past 4 weeks. The PSS contains 10 items, which are scored on a five-point Likert scale ranging from "never" to "all the time." The Dutch version of the PSS was used. The PSS has been translated into different languages and its validity has been demonstrated in several populations (Mitchell et al., 2008; Bellinghausen et al., 2009; Andreou et al., 2011; Nordin and Nordin, 2013). In the current study, the Cronbach's α coefficient of the PSS ranged between 0.86 and 0.89.

3.6.2 Secondary outcome measures

3.6.2.1 Well-being

The secondary mental health outcome is well-being. Emotional, social and psychological well-being was assessed using the Dutch version of the Mental Health Continuum-short Form (MHC-SF). The MHC-SF has been used and validated in previous Dutch studies (e.g., Westerhof and Keyes, 2010; Lamers et al., 2011; Franken et al., 2018). This is a self-report questionnaire consisting of 14 items on a six-point rating scale ranging from 0 (*never*) to 5 (*every day*). The Cronbach's α coefficient of the MHC-SF ranged between 0.87 and 0.91.

3.6.3 Proximal secondary outcomes

3.6.3.1 Mindfulness skills

The Five Facet Mindfulness Questionnaire Short Form (FFMQ—SF) was used to measure mindfulness skills (Baer et al., 2006). This self-report questionnaire contains 24 items on a five-point Likert-scale ranging from 1 "never or very rarely true" to 5 "very often or always true." This questionnaire consists of five subscales: observing, describing, acting with awareness, non-judging, and non-reactivity. The Dutch version of the FFMQ-SF has proven to be a reliable questionnaire, which is sensitive to change in a population with anxiety and depressive symptoms (Bohlmeijer et al., 2011). The Cronbach's α coefficient of the FFMQ – SF ranged between 0.77 and 0.80.

3.6.3.2 Emotion regulation skills

The Dutch self-report version for adults of the Behavior Rating Inventory of Executive Function (BRIEF-A, Scholte and Noens, 2011) was used to assess emotion regulation skills. For this study, we only used the subscale "Emotional Control," which consists of 10 items on a three-point Likert scale: "never," "sometimes," and "often." The Cronbach's α coefficient ranged between 0.90 and 0.91.

3.6.3.3 Self-compassion

The Dutch version of the short form of the Self Compassion Scale (SCS-SF) was used to assess self-compassion (Neff, 2016). This self-report questionnaire consists of 12 items on a seven-point Likert scale ranging from 1 "almost never" to 7 "almost always." It consists of six subscales: Mindfulness, Self-kindness, Isolation, Self-judgment, Over identification, and Common Humanity. The shortened scale shows a near-perfect correlation with the original Self Compassion Scale (Raes et al., 2011). The Cronbach's α coefficient of the SCS– SF ranged between 0.79 and 0.83.

3.6.4 Distal secondary outcomes

3.6.4.1 Teacher's self-efficacy

The Dutch version of the Teacher Sence of Efficacy Scale-Short Form (TSES-SF; Tschannen-Moran and Woolfolk Hoy, 2001) was used to measure successful teaching on four domains: coping with pressure and stress experienced at work, development possibilities within the workplace, job accomplishment and social interaction with pupils, parents and colleagues. The TSES-SF has been used and validated in previous Dutch studies (Hoogendijk et al., 2018). The TSES-SF consists of 12 items on a nine-point-Likert scale ranging from "1 (nothing)" to "9 (great deal)." The Cronbach's α coefficient of the TSES-SF ranged between 0.90 and 0.93.

3.6.4.2 Pupil-teacher relationship and classroom climate quality

The self-report teacher questionnaire of the Dutch Class Climate Scale (DCCS; Donkers and Vermulst, 2014) was used to assess teacher's perceptions of the classroom quality. The subscales "pupil-teacher relationship" (11 items) and "quality of classroom climate" (8 items) were included in this study. Both subscales scored on a four-point scale ranging from 1 (almost never) to 4 (often). The Cronbach's α coefficient of the subscale classroom climate quality ranged between 0.89 and 0.92 for the pupil-teacher relationship between 0.83 and 0.87.

3.6.5 Possible moderators

As moderators we include past or present psychological problems (coded as 0 = no, 1 = yes), school weight (coded as 0 = < regional weight average 1 = ≥ regional weight average), teachers' years of experience (in years) and age (in years).

3.6.6 Possible confounders

As a complicating factor, the onset of the COVID-19 pandemic occurred during this study. Chan et al. (2021) have highlighted the challenges that elementary teachers faced during the COVID-19 era, such as socially distanced classrooms and hybrid teaching, which brought about increased levels of stress and uncertainty, possibly impacting their teaching efficacy (Cho et al., 2021). Because of the possible impact of COVID-19 "school years" was additionally included as a categorical confounding variable (coded as 0 = before COVID-19, 1 = during COVID-19) in the sensitivity analyses next to the following potentially confounding baseline variables as stated in the protocol paper (Lensen et al., 2021) gender (coded as 0 = female, 1 = male), age (in years), school weight (coded as 0 = < regional weight average 1 = ≥ regional weight average), teachers' years of experience (in years), number of work days per week (in days), and past or present psychological problems (coded as 0 = no, 1 = yes).

3.7 Sample size calculation

In determining the necessary number of participants, we presumed a significance level (α) of 0.05 and a moderate effect size (δ) of 0.50 (e.g., Verweij et al., 2018). That study gives a good indication as the study population consisted also of professionals in a highly demanding job, was comparable in age and living situation and was not selected on psychological complaints. To reach 80% power, 64 participants had to be included in the intervention as well as the

control group. With an estimated dropout rate of 17.5%, comparable to the study from Verweij et al. (2018), we focused on recruiting 155 participants during three consecutive school years.

3.8 Data analyses

All analyses were conducted in R (R Core Team, 2020) using the packages esc for effect size calculation (Lüdecke, 2019) and lme4 (Bates et al., 2018) for linear mixed models and were in accordance with the previously published protocol (Lensen et al., 2021). A probability cut-off of $\alpha < 0.05$ was used for all analyses. Intention-to-treat analyses were conducted to examine the effect of the intervention on primary and secondary outcomes and proximal outcomes. Linear mixed models were used for the analyses, which adequately deal with missing data and can account for the multilevel structure of the data (Scott et al., 2013). In this study, observations were nested within participants, and participants were nested within MBSR-training groups and schools. However, since the intraclass-correlation (ICC) of the MBSR-training groups and schools (ICC < 0.01) was negligible, all models were fitted as two-level models including only random effects for observations nested within teachers (Theobald, 2018). All models were specified including random intercepts, as a more complex random intercept and slope model did not show a significantly better fit for the primary outcome perceived stress. The variance–covariance structure was set to compound symmetry, since a more complex unstructured covariance structure did not show a significantly better fit when compared with a likelihood-ratio test ($p = 0.64$). Restricted maximum likelihood was used for estimation in all models. To determine whether the intervention had an effect on the corresponding outcomes, fixed effects for time and group as well as their higher-order interaction were included in the mixed models. Furthermore, the models were repeated using per-protocol data including completers only. In this context, completion was defined as having attended at least four of the eight group sessions (Kuyken et al., 2015). Estimated marginal means and standard errors from the mixed models were used to calculate between-group Cohen's d effect sizes and corresponding 95% confidence intervals. Effect sizes >0.80 were considered large, effects >0.50 as moderate, and effect sizes >0.20 as small. As *post-hoc* tests, analyses of covariance (ANCOVAs) with condition and baseline scores as covariates were conducted to examine the effect of the intervention on primary and secondary outcomes at each timepoint. In line with the previously published protocol (Lensen et al., 2021), we did not account for potential covariates in the primary analyses. However, to determine whether including covariates substantially changed the models, sensitivity analyses were conducted in which all linear mixed models were re-ran with the following potentially confounding baseline variables included: gender, age, school weight, teachers' years of experience, number of work days per week, and past or present psychological problems (Lensen et al., 2021). To determine the potential impact of COVID-19, we additionally included a categorical confounding variable in the sensitivity analyses indicating whether people participated before or during COVID-19 (0 = before COVID, 1 = during COVID). To test the robustness of the results, outlier checks were performed for all outcomes and all timepoints. If outliers were

identified, we re-ran the analyses with these outliers excluded. Outliers were defined as scoring lower or higher than 3 standard deviations from the sample mean at the respective time point. Finally, the proportion of participants in both groups showing reliable change on the primary outcome was calculated for post-measurement and follow-up (Jacobson and Truax, 1992). Uncertainty surrounding the proportions was expressed with 95% binomial confidence intervals. Moderator analyses in terms of the primary outcome measure perceived stress were conducted using fixed effects models. Condition and the corresponding moderator were included as fixed effects as well as the interaction of the two variables. A significant interaction would indicate that the moderator influences the effect of the intervention. The following moderators were analyzed: past or present psychological problems, school weight, teachers' years of experience and age (Lensen et al., 2021).

3.9 Data availability, transparency, and openness

All data has been analyzed by an independent statistician and analyses are in accordance with the previously published protocol (Lensen et al., 2021). We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. This study was preregistered; see https://clinicaltrialregister.nl/nl/trial/21817. The data that support the findings of this study are available from the corresponding author upon request. Data were analyzed using R (R Core Team, 2020) using the packages esc for effect size calculation (Lüdecke, 2019) and lme4 (Bates et al., 2018) for linear mixed models.

4 Results

4.1 Sample characteristics

Of the 146 elementary school teachers who were randomized, eight dropped out before the pre-treatment assessment because they got another job ($N = 5$) or did no longer want to participate in the training ($N = 3$). Of the remaining 138, the majority was female ($n = 124$, 89.9%). The gender composition of our sample is consistent with the profession as a whole in the Netherlands (Statistics Netherlands, 2016, 2018). Almost all ($n = 130$, 94.2%) had a Western background. The average age of participants was 39.4 years old ($SD = 11.3$). The majority had quite a long term experience in teaching (Md 10–20 years). School weight was below average in slightly more than half of the participants. There were no relevant differences between the intervention group and the control group in terms of sociodemographic, clinical or professional characteristics. Descriptive characteristics of the participants are presented in Table 1.

4.1.1 Program completion

The number of sessions attended by each participant was noted by the mindfulness teacher. On average, participants attended 7.10 sessions, ranging from 4 to 8 sessions. The distribution of session attendance was as follows: two participants attended four sessions, two

TABLE 1 Baseline demographic characteristics participants total and by group.

	Total n = 138	MBSR n = 67	Control n = 71
	n (%)	n (%)	n (%)
Sociodemographic			
Gender			
Male	14 (10.1)	8 (11.9)	6 (8.5)
Female	124 (89.9)	59 (88.1)	65 (91.5)
Marital status			
Single	58 (42.0)	30 (44.8)	28 (39.4)
Married/living with a partner	72 (52.2)	35 (52.2)	37 (52.2)
Divorced/widowed/separated	8 (5.8)	2 (3.0)	6 (8.4)
Ethnicity			
Western background	130 (94.2)	63 (94.0)	67 (94.4)
Non-western background	8 (58)	4 (6.0)	4 (5.6)
Age M/SD	39.4/11.3	39.5	39.2
Children			
Yes	81 (41.3)	39 (58.2)	42 (59.1)
No	57 (58.7)	28 (41.8)	29 (40.9)
Education level			
Higher vocational education	105 (76.1)	51 (76.1)	54 (76.1)
Higher vocational educ. master	21 (15.2)	11 (16.4)	10 (14.1)
≥Academic bachelor/master	12 (8.7)	5 (7.5)	7 (9.8)
Clinical			
Current psychological symptoms			
No	123 (89.1)	58 (86.6)	65 (91.6)
Yes	15 (10.9)	9 (13.4)	6 (8.5)
Being treated for psychological symptoms			
No	35 (74.5)	18 (78.3)	17 (70.8)
Yes	12 (25.5)	5 (21.7)	7 (29.2)
Psychological complaints before			
No	84 (60.9)	40 (59.7)	44 (62.0)
Yes	54 (39.1)	27 (40.3)	27 (38.0)
Treatment before			
No	22 (30.6)	13 (35.1)	9 (25.7)
Yes	50 (69.4)	24 (64.9)	26 (74.3)
Professional			
Type of education teaching			
Regular elementary school	131 (94.9)	62 (92.5)	69 (97.1)
Elementary school special needs	7 (5.2)	5 (7.5)	2 (2.9)
Teaching group			
1–4	66 (47.8)	30 (44.8)	36 (50.7)
5–8	60 (43.5)	29 (43.3)	31 (43.7)
Combination 3–5 of 6–8	12 (8.7)	8 (11.9)	4 (5.6)
Years of employment			
<2	25 (18.1)	14 (20.9)	11 (15.5)
2–5	21 (15.2)	10 (14.9)	11 (15.5)
5–10	11 (8.0)	6 (9.0)	5 (6.0)

(Continued)

TABLE 1 (Continued)

	Total $n = 138$	MBSR $n = 67$	Control $n = 71$
	n (%)	n (%)	n (%)
10–20	49 (35.5)	21 (31.3)	28 (39.4)
20–30	24 (17.4)	9 (13.4)	15 (21.1)
>30	8 (5.8)	7 (10.5)	1 (1.4)
Days a week teaching (M)	3.9	4.0	4.0
School weight			
<Regional average	73 (52.9)	36 (53.7)	37 (52.1)
≥Regional average	65 (47.1)	31 (46.3)	34 (47.9)

participants attended five sessions, eight participants attended six sessions, 27 participants attended seven sessions, and 28 participants attended eight sessions.

4.2 Primary outcome: perceived stress

The results of linear mixed model analyses for primary and secondary outcomes are summarized in Table 2.

A significant group by time interaction was found for the primary (mental health) outcome perceived stress ($p < 0.01$), so the intervention was significantly more effective in decreasing perceived stress over time than the control condition. Large effects in favor of the intervention group were found for perceived stress at post-treatment ($d = -0.84$), and a moderate effect at follow-up ($d = -0.69$). Figure 4 shows estimated marginal means for perceived stress over time and across groups. Figure 5 presents all secondary outcome measures. Per-protocol analyses using completers only did not reveal different results compared to Intention-to-treat (ITT) analyses for the primary outcome.

4.3 Secondary outcomes

4.3.1 Well-being

Analyses of secondary outcomes showed significant group by time interactions for almost all secondary outcomes, with all effects being in favor of the intervention group. With regard to the mental health outcome measure of well-being, moderate between-group effect sizes at post-treatment and follow-up were found for well-being.

4.3.2 Proximal secondary outcomes

Analyses of proximal secondary outcomes showed significant group by time interactions for all proximal outcomes; mindfulness skills, self-compassion, and emotion regulation. All effects were in favor of the intervention group. Large effects were found for mindfulness skills and self-compassion at post-treatment and follow-up, and for emotion regulation at follow-up. Moderate between-group effect sizes were found for emotion regulation at post-treatment. Between-group *post-hoc* tests were significant for all proximal outcomes at all timepoints (p's < 0.05). Per-protocol analyses using completers only did not reveal different results compared to ITT analyses for the proximal outcomes.

4.3.3 Distal secondary outcomes

Regarding distal secondary outcome measures, large effects were found for teacher self-efficacy at post-treatment and follow-up and moderate effect sizes at both time points for teacher-perceived classroom climate quality. Between-group *post-hoc* tests were significant for almost all distal outcomes at all timepoints (p's < 0.05), except for classroom climate quality at post-treatment, which just fell short of significance ($p = 0.08$). No significant interaction effect was found for teacher-perceived pupil-teacher relationship ($p = 0.15$), and the between-group *post-hoc* tests did indicate that there was no significant between-group difference at any of the timepoint (p's > 0.10). Per-protocol analyses using completers only did not reveal different results compared to ITT analyses for the distal outcomes.

4.4 Sensitivity analyses

Adjusting the models for covariates did not change conclusions drawn from the models for primary and secondary outcomes. None of the covariates was significantly related with the outcome variable, and a significant group by time interactions were still found for all outcomes (p's < 0.01), except for the effect on the pupil-teacher relationship ($p = 0.15$). One outlier was identified for the primary outcome perceived stress at post-treatment. This person scored at least three standard deviations higher than the mean. However, excluding the data of this person from the analyses did not substantially change the results of the linear mixed model and between-group *post-hoc* tests. Also, one outlier was identified for teacher's self-efficacy at follow-up, class climate at post-measurement and pupil-teacher relationship at post-measurement and follow-up. In all cases, the scores were at least three standard deviations lower than the mean score. Again, excluding these cases from the data did not substantially alter the results.

4.5 Reliable change

The reliable change for the PSS was 0.50 in the current sample. For the primary outcome perceived stress at post-treatment, 26 people in the intervention group showed reliable change (38.8, 95% CI = 28.0–50.8), while seven people showed reliable change in the control group (10.0, 95% CI = 0.05–0.19). At follow-up, 28 people showed reliable change in the intervention group (41.8, 95% CI = 0.31–0.54) and 14 people in the control group (20, 95% CI = 0.12–0.31).

TABLE 2 Means and measurements.

|	Group	Pre (T0) M (SE)	Post (T1) M (SE)	FU (T2) M (SE)	Group × Time F	Between-group effect size *d* [95% CI] T1	Between-group effect size *d* [95% CI] T2
Primary outcome							
Mental health							−0.69 [−1.03; −0.34]
Perceived stress (PSS)	MBSR	1.74 (0.06)	1.49 (0.06)	1.41 (0.06)	10.81**	−0.84 [−1.19; −0.49]	
	WL	1.71 (0.05)	1.87 (0.05)	1.72 (0.05)			
Secondary outcomes							
Mental health							
Well-being (MHC-SF)	MBSR	2.93 (0.06)	3.33 (0.06)	3.39 (0.06)	11.09**	0.54 [0.20; 0.88]	0.72 [0.37; 1.06]
	WL	2.94 (0.06)	3.06 (0.06)	3.02 (0.06)			
Proximal outcomes							
Mindfulness skills (FFMQ-SF)	MBSR	3.18 (0.03)	3.41 (0.03)	3.48 (0.03)	46.16***	0.91 [0.56; 1.26]	1.37 [1.00; 1.74]
	WL	3.19 (0.03)	3.21 (0.03)	3.18 (0.03)			
Emotion regulation (BRIEF-A)	MBSR	0.68 (0.03)	0.48 (0.03)	0.47 (0.03)	16.55**	−0.74 [−1.09; −0.39]	−0.80 [−1.15; −0.46]
	WL	0.66 (0.03)	0.68 (0.03)	0.69 (0.03)			
Self-compassion (SCS-SF)	MBSR	2.89 (0.08)	3.62 (0.08)	3.82 (0.08)	40.19***	0.88 [0.53; 1.23]	1.26 [0.90; 1.63]
	WL	2.95 (0.07)	3.07 (0.07)	3.02 (0.07)			
Distal outcomes							
Teacher's self-efficacy (TSES-SF)	MBSR	5.21 (0.07)	5.75 (0.07)	5.97 (0.07)	20.07***	0.78 [0.44; 1.13]	0.86 [0.51; 1.21]
	WL	5.26 (0.07)	5.32 (0.07)	5.49 (0.07)			
Pupil-teacher relationship	MBSR	2.37 (0.03)	2.52 (0.03)	2.58 (0.03)	2.11	0.30 [−0.03; 0.64]	0.29 [−0.05; 0.63]
	WL	2.38 (0.03)	2.44 (0.03)	2.50 (0.03)			
Classroom climate quality	MBSR	2.45 (0.02)	2.53 (0.02)	2.59 (0.02)	10.08**	0.49 [0.15; 0.83]	0.62 [0.28; 0.96]
	WL	2.45 (0.02)	2.44 (0.02)	2.48 (0.02)			

4.6 Moderator analyses

No significant moderation effects were found for any of the baseline variables past or present psychological problems, school weight, teachers' years of experience and age on the primary outcome at post-measurement.

5 Discussion

Given the elevated levels of stress symptoms among teachers, the principal aim of this study was to assess whether participation in a standard MBSR training could result in a reduction of perceived stress among elementary school teachers. Results indeed demonstrated that teachers in the MBSR group reported significantly lower perceived stress levels at both post-treatment and the 3-month follow-up compared to those in the waitlist control group, with substantial to moderate effect sizes between the groups. While no significant effects emerged regarding teacher-perceived pupil-teacher relationships,

teachers in the MBSR group reported significantly higher levels of well-being and moderate to large improvements in self-efficacy and classroom climate quality, both at post-treatment and the 3-month follow-up. Moreover, beyond these effects, substantial enhancements were observed in proximal outcome measures, including mindfulness skills and self-compassion at both post-treatment and 3 months follow-up. For emotion regulation, these improvements were of moderate magnitude. Our findings are in line with previous work in predominantly mixed teacher populations, which also found positive effects of mindfulness interventions on teacher stress and well-being (e.g., Emerson et al., 2017; Hwang et al., 2017; Klingbeil and Renshaw, 2018; de Carvalho et al., 2021). The current study adds to these findings by focusing exclusively on elementary school teachers and examining effects of the standard MBSR program without adaptations to the educational field, which might be easier to implement on a larger scale.

Where the present study showed large effects on teachers' self-efficacy, earlier studies on elementary school teachers—using adapted teacher MBIs—show mixed findings. For example, the research

FIGURE 4
Time point and group primary outcome.
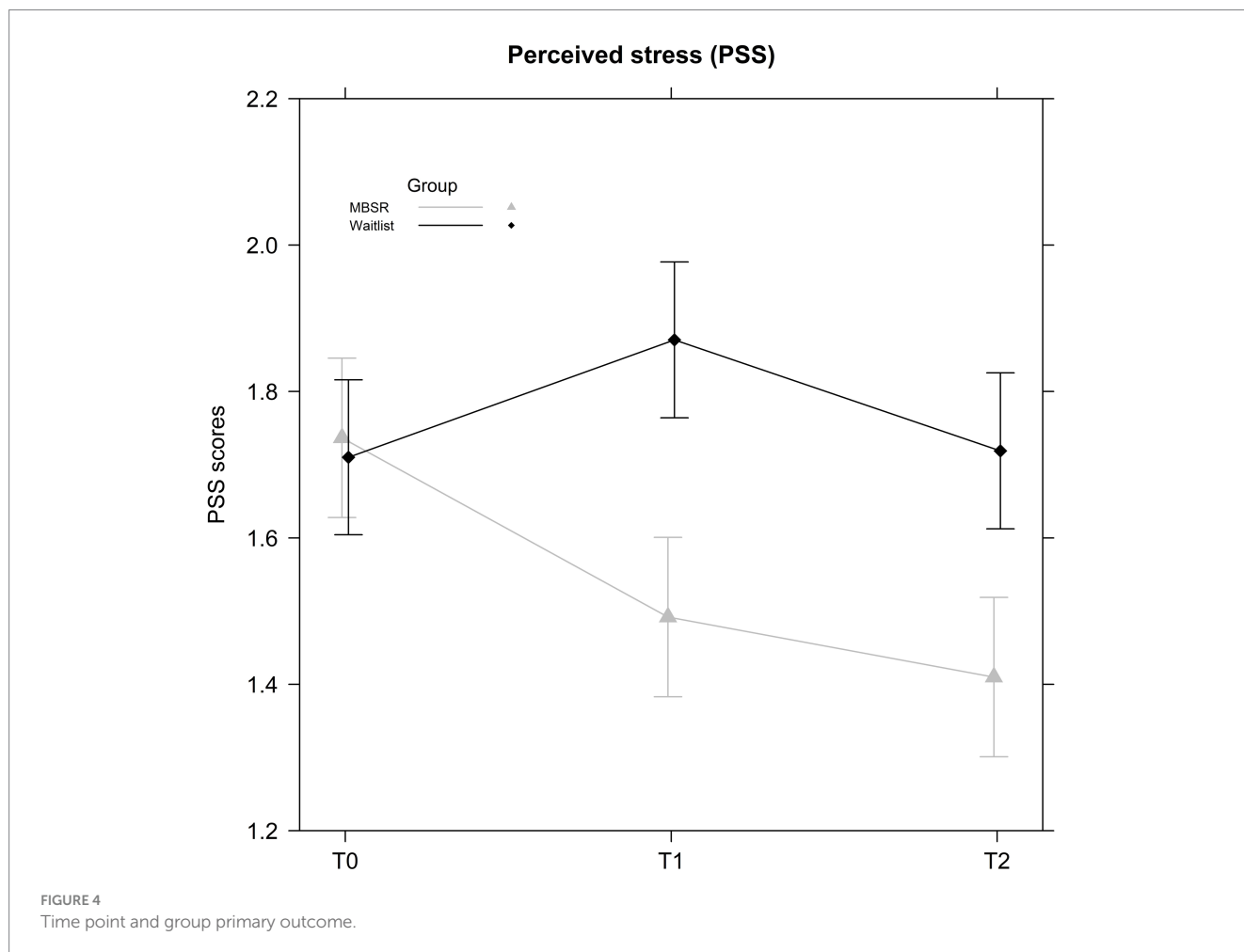
conducted by Jennings et al. (2017) demonstrated no effects on teacher self-efficacy, while the study by de Carvalho et al. (2021) revealed significant effects. Conversely, both systematic reviews on mixed teacher populations (Emerson et al., 2017; Hwang et al., 2017) reported only small effects on teacher self-efficacy. While replication of our findings is warranted, elementary school teachers' self-efficacy seems to benefit considerably from standard MBSR training.

While we did not observe significant enhancements in teacher-perceived pupil-teacher relationships, it is noteworthy that previous studies included in the meta-analysis by Klingbeil and Renshaw (2018) generally reported small effects. In contrast, concerning classroom climate quality, the effects documented in the meta-analysis (Klingbeil and Renshaw, 2018) were modest, whereas our recent study demonstrated substantial to moderate effects. The mixed study conducted by de Carvalho et al. (2021), exclusively focusing on elementary school teachers, also showcased promising effects on classroom climate quality through classroom observations.

A plausible explanation for the absence of effects on pupil-teacher relationships and the larger effects observed in classroom climate quality in our current study might be attributed to the notion that changes in teaching behavior could exert a more immediate impact on overall classroom climate quality than on individual pupil-teacher relationships. Furthermore, behavioral change necessitates time and commences with an understanding of thoughts and unhelpful

patterns, a process that evolves during the training and may only result in behavioral adjustments later on Tang et al. (2015). It is plausible that changes in pupil-teacher relationships might require an even more extended period to manifest.

It is essential to acknowledge that the meta-analysis (Klingbeil and Renshaw, 2018) and systematic reviews (Emerson et al., 2017; Hwang et al., 2017) encompassed numerous smaller studies with a mixed teacher population, and only a limited number included follow-up assessments. Long-term follow-ups are imperative to comprehensively explore the evolution of pupil-teacher relationships, potentially integrating observations or feedback from the pupils' perspective on the relationship.

The observed effects on mindfulness skills, emotion regulation, and self-compassion align with our proposed theory of change. We hypothesized that the intervention's impact on reducing perceived stress would be accompanied by enhancements in mindfulness skills, emotion regulation, and self-compassion (Hölzel et al., 2011; Vago and Silbersweig, 2012; Tang et al., 2015; Kristin et al., 2018; Neff, 2023).

5.1 Moderation

Moderation analyses revealed no significant effects for any of these variables on the primary outcome at post-treatment. Contrary
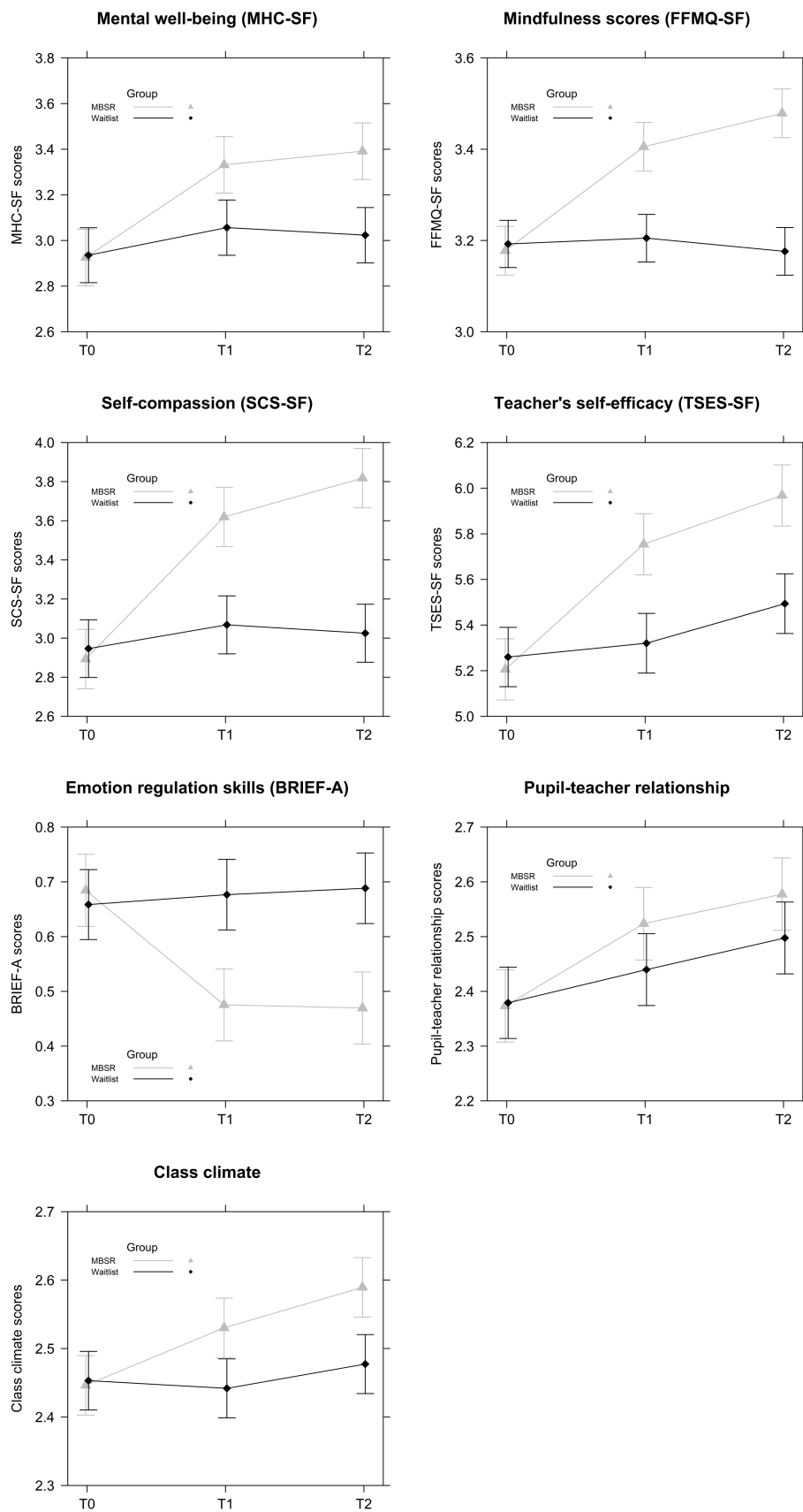
FIGURE 5
Time point and group secondary outcomes.

to our expectations, our findings deviated from indications discovered in a pilot study conducted before this RCT (Lensen et al., 2022). The pilot study suggested that teachers' past or present psychological problems and the school weight could potentially moderate effects, indicating larger benefits of MBSR for teachers in high school weight (high-risk) schools and for those who have had or currently have symptoms of psychological problems. Additionally, a study by Jennings et al. (2011) suggested that an MBI might exert a larger effect on teachers who worked in schools with more complex pupil populations, which is related to school weight. It is also inconsistent with the study of Roeser et al. (2022) indicating that newer teachers (<5 years) showed better personal and classroom outcomes at follow-up than more experienced teachers.

The absence of moderation effects of past or present psychological problems, school weight, years of experience, and age, may suggest that the benefits of the MBSR training were consistent across different teachers, schools, and intervention characteristics, indicating its broad applicability. Nevertheless, it is crucial to note that the moderation analyses were exploratory in nature, and it is plausible that the power was insufficient to detect moderating effects. Therefore, firm conclusions regarding this aspect cannot be drawn.

5.1.1 COVID-19

The COVID-19 pandemic, with its profound effects on teachers and heightened stress levels, introduced numerous challenges during this period. Recognizing the potential confounding impact of COVID-19 on our study results, we incorporated it as an additional variable in the sensitivity analyses. Participation before or during COVID-19 was not associated with any of the outcomes, nor were results altered after including COVID-19 as potential confounder. It may be the case that MBSR contributed significantly to the improvement of teachers' resilience, thereby buffering the possibly adverse effects of COVID-19 on their stress (Cho et al., 2021). For instance, previous research has demonstrated that teachers' self-efficacy, a protective factor for resilience, played a crucial role in facilitating successful online teaching (König et al., 2020). Therefore, it is plausible that MBSR provided additional support to teachers in managing their stress during COVID-19. Furthermore, Flemish qualitative research has revealed that teachers employed various strategies, including mindfulness, to cope with the increased perceived stress caused by COVID-19 (Desmet, 2021). Earlier investigations indicated that elementary school teachers reported lower levels of COVID-19 stress in comparison to their secondary school counterparts (Klapproth et al., 2020). It is plausible that a similar trend occurred in our study, and the impact of COVID-19 was less pronounced than anticipated. Since we did not directly inquire about the specific impact of COVID-19 on teachers' perceived stress and teaching, caution is warranted in drawing definitive conclusions from the findings in our current study.

5.2 Strengths, limitations, and future research

This study employed a bottom-up approach. Teachers seeking relief from ongoing stress were facilitated to participate in an MBSR training at a regional University of Applied Sciences. Positive experiences led to a pilot study, culminating in this RCT. Teachers found the mindfulness training valuable in their demanding professional lives, as evident from high participation rates.

Importantly, the study leverages an existing training intervention, ensuring widespread availability for prompt, personalized implementation in educational settings at various levels. This study also has limitations. First, participation was voluntary, potentially affecting the applicability of findings to mandatory program attendees. The urban-centric study population may limit generalizability, given regional stress variations (Abel and Sewell, 1999). All groups had the same mindfulness teacher, impacting generalizability. Future research should diversify geographical regions, trainers, and explore various program delivery features for a comprehensive understanding (Hill et al., 2013).

Secondly, this study relied on self-reported questionnaires, introducing the possibility of social desirability and other biases (Caputo, 2017). The assessment of teaching quality, in particular, might have benefited from additional observer-rated measures. For future research, it is important to consider incorporating more objective outcome measures alongside self-report data, aligning with the notion of utilizing direct observations of classroom variables or informant-report measures (Klingbeil and Renshaw, 2018). Moreover, relying on a single source of information tends to overinflate the significance and size of detected effects. We suggest to include pupil perspectives and to further explore teachers' experiences through qualitative research methods to gain a more in-depth understanding of their perceptions regarding the impact of MBSR. In that regard, it might also be interesting to investigate to what extent the MBSR for teachers has an effect on pupil performance. Additionally, investigating whether MBSR enhances teaching quality, as assessed by the adoption of an enthusiastic and motivating style, could provide valuable insights as well (e.g., Keller et al., 2016; Taxer and Frenzel, 2018; Moè and Katz, 2022). Last, because the control group was a waiting list rather than active control group the study design does not allow to differentiate between specific and non-specific effects of (parts of) the intervention.

5.3 Implications

Many school organizations are seeking a way to reduce teachers' perceived stress without compromising the quality of teaching and education. Based on our findings, it might be beneficial to implement MBSR within educational settings as a stress prevention intervention. We do stress the importance of addressing perceived stress in elementary school teachers not only through individual interventions, but to also take the broader context and system into account in which teachers operate.

6 Conclusion

The present study provides compelling evidence that standard MBSR training affects mental health through reducing perceived stress and improving well-being in elementary school teachers. Teacher self-efficacy and classroom climate quality also significantly improved, as well as mindfulness skills, emotion regulation and self-compassion. If school leaders, policymakers, and educational systems endorse the cultivation of both personal resilience and professional development among teachers nationwide, the systematic integration of MBSR into the curriculum should be considered.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Internal Review Board Ethics Committee Social Science, Faculty of social sciences Radboud University, 06 June 2019, Reference number: ECSW-2019-029. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

JL: Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Validation, Writing – original draft. SS: Conceptualization, Data curation, Methodology, Resources, Writing – review & editing. MK: Conceptualization, Methodology, Writing – review & editing, Resources. JK: Data curation, Formal Analysis, Writing – review & editing. RS: Conceptualization, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing. AS: Conceptualization, Methodology, Project administration, Resources, Supervision, Validation, Writing – review & editing.

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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