



Mindfulness in Preadolescents—A Feasibility Study on the Efficacy and Acceptance of a School-Based Training (“8SAM”)

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Abstract

Objectives Interest in mindfulness-based programs for students in school settings is growing. Few such programs exist for secondary schools in Germany and none is specifically tailored for integration into the full-year 5th grade school curriculum. Moreover, qualitative surveys of student acceptance are lacking. Therefore, this study assessed the efficacy and acceptance of a school-based mindfulness training (“8SAM”) tailored for preadolescents in the 5th grade.

Methods In this feasibility study, the mindfulness training was implemented by trained classroom teachers in a German gymnasium (a type of secondary school) as part of the regular school curriculum for an entire school year. In total, 95 preadolescents aged 10–12 years participated. Following a mixed-methods approach, both quantitative and qualitative instruments were employed. Self-report measures based on the German version of the Child and Adolescent Mindfulness Measure (CAMM) were longitudinally assessed at baseline (t_0), mid-intervention (t_1), and post-intervention (t_2). Acceptance of the training was surveyed using quantitative and qualitative self-reports.

Results A one-way repeated measures ANOVA revealed a significant main effect of time ($F(1.66, 151.41) = 14.23, p < 0.001, \eta_p^2 = 0.14$), with mindfulness increasing at t_1 and t_2 . Acceptance was more ambiguous: 52.43% of preadolescents liked the “quiet” and “calm” atmosphere or interactive exercises whereas 17% rated the training as “boring.”

Conclusions The findings suggest that 8SAM (a) can be implemented by classroom teachers as part of the regular full-year 5th grade curriculum and (b) may increase mindfulness in preadolescents. Furthermore, (c) to increase preadolescents’ subjective benefits and acceptance, more age-appropriate didactic approaches need to be identified and implemented.

Preregistration This study is registered at the German Clinical Trials Register (DRKS00015044).

Keywords Mindfulness · School · Acceptance · Preadolescents · 8SAM

Mindfulness is often defined as an awareness of the present moment, accompanied by non-judgmental acceptance and an open-hearted attitude (Kabat-Zinn, 1990). A variety of well-evaluated mindfulness-based programs (MBPs) are available, especially for adults (Zhang et al., 2021). MBPs commonly incorporate experiential formal and informal practices rather than theoretical didactic approaches to train moment-to-moment awareness (Crane et al., 2017). Research showed that MBPs could reduce pain, psychological distress, and mood disturbance in adults with chronic

pain, and yield improvements in anxiety, depression, and concentration (Bawa et al., 2015; Hoge et al., 2013; Morais et al., 2021). In order to expand these findings, there is a growing interest in developing MBPs for preadolescents and adolescents (Emerson et al., 2020), frequently using school settings.

Besides the knowledge that students acquire in subjects such as mathematics, art, or biology, in order to thrive in the face of a wide variety of stressors and cope effectively with the looming challenges of adulthood, the development of focused attention, socio-emotional skills (e.g., self-awareness, self-regulation, self-efficacy, and empathy), and resilience is highly relevant (Andreu et al., 2021). In this context, mindfulness can be highly beneficial to children and adolescents in numerous ways (Maynard et al., 2017). These benefits include (1) learning to focus on the here and now, directing attention to

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the current task (Eduljee et al., 2022; Verhaeghen, 2021); (2) increasing resilience by helping to reduce anxiety, depression, and stress while simultaneously increasing impulse control and emotion regulation, and fostering a calm demeanor even when faced with stressful situations (Kane, 2018; Lin et al., 2019); and (3) improving competency for learning by promoting attention and general executive function (Mak et al., 2018). A MBP that is integrated into the school curriculum may therefore provide a cost-effective and efficient foundation to cultivate students' emotion regulation, affect, behavior, and well-being, ultimately leading to both increased happiness and a better academic performance in a holistic manner (Güldal & Satan, 2022; Phan et al., 2022).

In recent years, various MBPs have been developed to teach mindfulness in the school context. The *Paws b* program, developed in the UK as part of the Mindfulness in Schools Project (*MiSP*), is a curriculum for 7–11-year-olds delivered in twelve 30–60-min sessions by teachers trained through a separate preparation course (*Teach Paws b*). Vickery and Dorjee (2016) conducted a controlled feasibility pilot study in a sample of 7–9-year-olds which showed a significant decrease in self-reported negative affect with a large effect size ($d=0.84$) at follow-up, as well as significant improvements in teacher-reported meta-cognition, also with a large effect size ($d=1.08$). Additionally, Thomas and Atkinson (2016) evaluated *Paws b* in two classes of 8–9-year-olds in a randomized controlled trial (RCT) and found positive effects in terms of improving attentional functioning. The *.b* program, which consists of ten 40–60-min sessions, is the counterpart to *Paws b* for students aged 11–18 years, adapted to their age-specific needs. In the 8-year MYRIAD (My Resilience in Adolescence) project, a parallel group, cluster-randomized controlled trial, the *.b* curriculum showed no positive effects compared to a control group consisting of a standard social-emotional teaching program (Kuyken et al., 2022). The *MindUP Project* (Maloney et al., 2016) focusses on students in the age of 3–14 years consists of 15 units focusing on mindfulness and social and emotional learning competencies. In a RCT with 4th and 5th graders, Schonert-Reichl et al. (2015) found positive effects of the program on executive functions and several components of socio-emotional skills (i.e., self-reported emotional control). In a quasi-experimental study, de Carvalho et al. (2017) evaluated the efficacy of the *MindUP* program in 3rd and 4th graders. Compared to the waitlist control group, the intervention group showed improvements in their ability to regulate emotions (less self-reported suppression of emotions) as well as less negative and more positive affect. From 5th grade onwards, the *MIS-CHO* can be used by trained teachers. In a controlled pilot study, 5th grade students received four introductory lessons (consisting of 45-min units) followed by three 10-min units

per week. Compared to the control groups, the intervention group showed positive effects regarding the regulation of sustained attention and emotional self-regulation (Kaltwasser et al., 2014). Another school-based training program is *8-sam*, a 4-week mindfulness program designed to promote self-regulation in 9th grade students (Frenkel et al., 2020). While similarly named to the training used in the present study, the two trainings were developed independently of each other. Therefore, both trainings are substantially different in terms of objective, structure, and content and are clearly distinguishable with regard to the duration of the training and the sessions themselves, the age of the target group, and the individual who guides the students through the respective training. The eight 25-min training sessions of *8-sam* were implemented by research assistants with a background in psychology and education, who had all received training on *8-sam* prior to implementing the sessions. A RCT with a total sample of 46 9th grade students revealed a reduction in other-perceived mind wandering and moderate to good acceptance (Frenkel et al., 2020).

All of the aforementioned programs are fully manualized and offer a fixed number of sessions and materials. Except *.b* and *MISCHO*, which can both be integrated into the school curriculum over a whole school year, the longest implementation period was 12 weeks including weekly mindfulness sessions. Most of the programs demonstrate benefits for students in different quantitative measurements, e.g., reductions of depressive symptoms and stress, improvements in executive function and mind wandering, and increased well-being or emotion regulation (Engel et al., 2020). It should be noted that only one trial (MYRIAD) investigated iatrogenic effects, in which a small increase in depressive symptoms was registered for those students, who had elevated levels of mental health symptoms at baseline (Montero-Marin et al., 2022). Besides efficacy, adverse effects (e.g., affective impairments due to unpleasant or distressing memories brought up by mindfulness practice) associated with mindfulness trainings should be registered to assess both benefits and potential harm (Foulkes & Stringaris, 2023).

Besides these results, only a few studies assessed students' acceptance of the MBPs, and those that did revealed a moderate acceptance of mindfulness practice (*8-sam*; Frenkel et al., 2020; Kuyken et al., 2022). This seems highly relevant, as Saltzman and Goldin (2008) found that engagement and consequently intervention success are highest when students consider the experience of mindfulness-based courses to be fun. Moreover, as mindfulness requires practice and adherence to achieve the best results, participants' self-sustained engagement and commitment are likely factors that maintain success. Analogous to Himelstein et al. (2012) who mentioned the importance of the subjective perspective of students, quantitative research could be complemented with qualitative approaches—even more to understand how

mindfulness can best be taught in this age group. However, with the exception of the programs of the *MindUP Project*, none of the above-mentioned studies qualitatively examined student acceptance.

The present study investigated the efficacy and acceptance of a weekly mindfulness training (“8SAM”) using both quantitative and qualitative measures. Participation in the 8SAM training was expected to enhance participants’ mindfulness, which we hypothesized to be reflected in a significant increase in participants’ self-reported level of mindfulness (operationalized using the Child and Adolescent Mindfulness Measure; CAMM) during the intervention (Hypothesis 1). The second focus of this feasibility study was to evaluate participants’ acceptance of the 8SAM curriculum in a mixed-methods approach, using a quantitative and qualitative evaluation format, which is a novel approach compared to previous studies. In view of previous findings (Frenkel et al., 2020), we expected participants’ acceptance of 8SAM to lie in a moderate range (Hypothesis 2). This evaluation will allow us to gain a better understanding of how preadolescents experience the training and how mindfulness trainings need to be designed such that they specifically address the needs and requirements of students of the 5th grade.

Method

Participants

An a priori power analysis was conducted using G*Power (Faul et al., 2007) to determine the minimum sample size required to test the study hypothesis. Results indicated the required sample size to achieve 80% power for detecting a small effect at a significance criterion of $\alpha = 0.05$ is $n = 66$ for univariate single-factor repeated measures analyses of variance (rmANOVA). Thus, the obtained sample size of $n = 95$ was deemed adequate to test the study hypothesis. The students were recruited from a 5th grade made up of four classes at a German gymnasium (BE, grammar school; AE, high school; out of 100 students; participation rate = 95%). Three participants were excluded due to missing baseline data, resulting in a final sample size of 92 participants, consisting of 38 females (41.3%) and 54 males (58.7%). The participants’ age ranged from 10 to 12 years at baseline with the majority (82.61%) being 10 years old.

Procedures

Before beginning the study intervention, the teachers participated in a 1-day mindfulness workshop organized by the study team. Teachers were trained on the concepts and theories underlying 8SAM as well as its implementation in

the classroom. To promote a standardized implementation, the teachers were provided with an instruction manual containing explanations of the general approach (e.g., the attitudes teacher should show), instructions on implementing the training, advice on dealing with difficult situations, and suggestions for formulating the delivered training contents. An essential part of the manual is the assortment of more than 40 specific mindfulness exercises with different structures (i.e., experimental, contemplative and self-reflective individual, dyad, and group exercises). Form teachers were specifically chosen to deliver the intervention, based on their experience working with the students and their ability to handle potentially arising complications.

Next, the teachers implemented 8SAM in their school classes. To emphasize the separation and withdrawal from the regular classroom setting, the training took place in a *Room of Silence*—a separate room from the classroom. In order to standardize and supervise the delivery of 8SAM, all teachers remained in close contact with the 8SAM coordinators and quarterly supervision sessions were provided.

Participants were assessed at three time points over the course of the study: (1) baseline assessment at the beginning of the 2018/2019 school year (t_0); (2) mid-intervention assessment (t_1); and (3) post-intervention assessment at the end of the 2018/2019 school year (t_2). In addition, participants were asked to evaluate the impact and acceptance of the 8SAM training at t_2 .

The 8SAM Training

8SAM is an integrative learning approach with psychoeducational components, incorporating elements and practices of mindfulness into the existing 5th grade syllabus. The training aims to be a universal, semi-structured school-based prevention training that serves to train a mindful attitude towards and acceptance of one’s own cognitions and emotions, based on the definition of mindfulness by Kabat-Zinn (1990, 2016). By doing so, it seeks to improve self-awareness, attentional control, and emotion regulation and facilitate healthy stress regulation.

The 8SAM training consists of one 45-min mindfulness session per week, which was integrated into the regular curriculum of the four participating classes over a period of 11 months (the length of one school year) and implemented by trained teachers. In contrast to similar trainings, the 8SAM curriculum is semi-manualized, offering a characteristic session structure. The internal structure of each session follows a standardized, consistent scheme: (1) A “Welcome ritual” is employed, as rituals facilitate engagement in the mindful time (Hanh & Weare, 2017) and signal the beginning of the practical training phase; upon entering the classroom, participants are welcomed individually by the teacher with a previously defined welcome ritual and then

greet each other; (2) “Repetition of mindfulness exercises” for several weeks in order to practice them intensively and to notice learning effects; in the present study, a selection of three exercises was offered, e.g., listen to the sound of the singing bowl; (3) “Mindfulness exercise and debriefing”: Teachers select from a collection of calm or active mindfulness exercises according to participants’ current needs; this is followed by a short debriefing in the form of a short feedback session, e.g., offering them the possibility to describe their feelings during the exercise; (4) “Closing the lesson” with a voluntary thankfulness exercise and a special goodbye signal. The repetitive structure of the training sessions provides a standardized implementation and fosters participants’ familiarity, while the ability to choose from the different exercises within the active and calm units allows the training to be adapted to the participants and teachers rather than vice versa. In addition, at the very beginning of the training, a psychoeducational, theoretical lesson with background information takes place. The training itself was designed to be interactive, fostering sharing among the participants, and age-appropriate (e.g., with the help of *Sam*, an eight-armed octopus that serves as the training’s guiding figure, the main components of mindfulness can be discussed and illustrated using common metaphors such as “surfing the waves of stress”).

Measures

As there were no validated instruments for the standardized assessment of children’ and preadolescents’ mindfulness in German-speaking countries at the time of data collection, we translated an English-language-based valid instrument into German. To check the validity of our translation, we translated it back and compared it to the initial English version. Based on a literature search and a comparison of existing instruments, the Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011) was chosen, which is highly

economical. The CAMM was originally developed and validated for English-speaking adolescents, but has proven to exhibit equally good properties in translated adaptations (e.g., Dion et al., 2018; García-Rubio et al., 2019; Viñas et al., 2015). Although assessing mindfulness in preadolescents and adolescents using self-report instruments is challenging since their reading and self-reflection skills are still developing, a recent review of the suitability of mindfulness measures for young people concluded that the CAMM is a valid and reliable instrument (Pallozzi et al., 2017).

The CAMM is a 10-item self-report questionnaire, each of them being rated on a 5-point Likert scale, which was specifically designed for measuring children’s and adolescents’ mindfulness (aged 10–17). It has shown a satisfactory internal consistency of $\alpha=0.81$ and was found to favor a one-factor solution (Kuby et al., 2015). The CAMM yields a total score between 0 and 40 with lower scores indicating higher self-reported mindfulness. We inverted the scale so that higher scores represent higher self-reported mindfulness to facilitate the interpretability of the results.

German CAMM

We translated the original English version by Greco et al. (2011) into German, then back-translated it into English to verify its wording and achieve the highest conformity with the original. Translation and back-translation were conducted by two independent researchers. The order of items was maintained. A confirmatory factor analysis was performed using lavaan (Rosseel, 2012) to compare the CAMM’s internal consistency, revealing yielding a significant overall model, $\chi^2(35) = 60.10$, $p < 0.01$. Factor loadings showed a comparable pattern to those reported by Greco et al. (2011), with the general model also favoring a one-factor solution. Corresponding factor loadings for each item at baseline are summarized in Table 1. To examine scale reliability and internal consistency of the

Table 1 Items and corresponding factor loadings for the German translation of the CAMM

Question	t_0
1. Ich rege mich über mich selbst auf, wenn ich Gefühle habe, die keinen Sinn ergeben	0.84***
2. In der Schule laufe ich von Unterricht zu Unterricht, ohne zu bemerken, was ich tue	0.57***
3. Ich halte mich beschäftigt, damit ich meine Gedanken und Gefühle nicht bemerke	0.48***
4. Ich sage mir, dass ich nicht so fühlen sollte, wie ich mich fühle	0.61***
5. Ich schiebe Gedanken weg, die ich nicht mag	0.47***
6. Es fällt mir schwer, ausschließlich auf eine Sache zu achten	0.65***
7. Ich rege mich über mich selbst auf, wenn ich bestimmte Gedanken habe	0.91***
8. Ich denke über Dinge nach, die in der Vergangenheit passiert sind, anstatt an Dinge zu denken, die gerade jetzt passieren	0.78***
9. Ich denke, dass manche meiner Gefühle schlecht sind und ich sie nicht haben sollte	0.87***
10. Ich halte mich davon ab, Gefühle zu haben, die ich nicht mag	0.67***

Note. *** $p < 0.001$

German CAMM, we estimated Cronbach's α (Cronbach, 1951), and found a high Cronbach's α ($\alpha_{t_0} = 0.83$), which is comparable to the value reported by Greco et al. (2011). The McDonald's omega was $\omega_{t_0} = 0.84$.

Finally, we assessed the discriminant validity between the German CAMM and the Global Severity Index (GSI) of the Brief Symptom Checklist (BSCL; Franke, 2000), which represents overall psychopathological distress. The BSCL contains 53 items assessing subjective physiological and psychological symptoms. Items are rated on a 5-point Likert scale according to the extent to which the described symptom has been experienced in the last 7 days. The BSCL is well-validated and the GSI shows very good internal consistency (Cronbach's $\alpha = 0.97$). We found a statistically significant, high negative correlation between the GSI and the German CAMM ($r_{t_0} = -0.52$), comparable to the values reported in previous mindfulness research (e.g., Bergomi et al., 2013; Böge et al., 2020; Gaiswinkler & Unterrainer, 2016). With a high correlation coefficient (Cohen, 1988), a substantial amount of disparate co-variance and a negative correlation, discriminant validity was shown. Overall, the results provide further evidence for the utility and efficacy of the translation and its comparability with the original English language version.

Acceptance Questionnaire

Participants' acceptance of the intervention was assessed using both quantitative and qualitative self-reports. To capture acceptance, we designed a questionnaire (see the Appendix for complete questionnaire) containing items assessing participants' interest in the topic, their satisfaction with the exercises, the atmosphere during the training, and the implementation by the teachers. This self-constructed questionnaire additionally assesses the transferability of the exercises to everyday life and the participants' current mindfulness practice. Participants can assign an overall grade to the training and decide for or against recommending the training to others. In total, the questionnaire consists of 14 items: eight multiple-choice items in a Likert scale format (ranging from 1—*completely* to 6—*not at all*), a further multiple-choice item capturing the overall grade for 8SAM (according to the German grading system denoting 1 as the best grade and 6 as the worst grade), two multiple-choice items in the format 1—*never*, 2—*sometimes*, 3—*regularly*, and one dichotomous item. To complement the quantitative evaluation with a qualitative assessment, two open-ended questions were included, in which participants were asked to indicate what they especially liked and disliked about the intervention.

Data Analyses

Quantitative data analyses were performed using SPSS 26, JASP 0.14.1, and R 3.6.3. Responses to the CAMM included 12.96% missing values. To analyze whether there were any patterns in missing data, we conducted Little's test, which was non-significant and thus indicated that the CAMM questionnaire data were all missing completely at random (MCAR). Missing data were imputed using the R package *missForest* (Stekhoven & Bühlmann, 2012), an iterative nonparametric missing value procedure based on a random forest estimator (Tabachnick & Fidell, 2018). Sum scores of the CAMM for all three measurement time points were visualized using a violin plot. Changes in the outcome variable over time were analyzed using univariate single-factor rmANOVA with the 3-level within-subject factor of time. The assumption of sphericity was tested using the Mauchly test; Greenhouse–Geisser correction was used to adjust for any violations. To control for possible gender effects found in previous studies (Kang et al., 2018; Lassander et al., 2021) and increase statistical power, we included gender as a covariate into the previous rmANOVA. In line with Cohen (1988), effect sizes were considered small if $\eta^2 \geq 0.01$, medium if $\eta^2 \geq 0.06$, and large if $\eta^2 \geq 0.14$. Significance levels of all post hoc tests were adjusted for multiple comparisons using the Bonferroni–Holm correction (Holm, 1979).

To evaluate the responses to the acceptance questionnaire, we calculated means, standard deviations, and frequencies. In addition, internal consistency was calculated for the Likert scaled Items 1–8 using Cronbach's alpha. Internal consistency is reviewed as reliable if the alpha value is above 70% (Tavakol & Dennick, 2011). As an aspect of content validity, the correlation between the mean value of Items 1–8 and the overall grade for 8SAM (Item 9) was calculated. In line with Cohen (1988), Pearson correlation coefficient is considered small if $r \geq 0.10$, medium if $r \geq 0.30$, and large if $r \geq 0.50$.

Qualitative analyses were conducted as directed qualitative content analysis (Assaroudi et al., 2018). For qualitative analyses of the answers to the open-ended questions, an independent researcher developed a formative categorization matrix based on theoretical main categories and the participants' answers and coding rules. The matrix was pre-tested and cross-checked by a second researcher. Subsequently, the answers were classified by two additional independent researchers and then compared, and discrepancies were finally classified by another researcher. If necessary, preliminary codes were then further abstracted into main categories in order to synthesize the results. In addition to presenting answers in their original wording, we decided to calculate prevalence rates of categories in order to further classify the results.

Results

Self-Reported Mindfulness

Self-reported mindfulness was assessed over the course of the intervention using the CAMM and analyzed using a one-way repeated measures ANOVA with the three-level factor time (t_0 , t_1 , t_2). The results revealed a significant main effect of time, $F(1.66, 151.41) = 14.23$, $p < 0.001$, $\eta_p^2 = 0.14$. Figure 1 plots the development of mean inverted CAMM scores from the baseline assessment (t_0) over the mid-intervention assessment (t_1) to the post-intervention assessment (t_2).

Bonferroni-adjusted post hoc tests showed statistically significant differences in CAMM scores between t_0 and t_1 , $M_{\text{Diff}} = -3.28$, $t(91) = 4.10$, $p_{\text{Holm}} < 0.001$, $d = 0.43$, and between t_0 and t_2 , $M_{\text{Diff}} = -4.01$, $t(91) = 5.01$, $p_{\text{Holm}} < 0.001$, $d = 0.52$, but not between t_1 and t_2 , $M_{\text{Diff}} = -0.73$, $t(91) = 0.91$, $p_{\text{Holm}} = 0.37$, $d = 0.10$. Means and standard deviations of CAMM scores are presented in Table 2.

Including gender as a covariate into the previous rmANOVA on CAMM scores yielded a significant effect of time, $F(1.70, 153.19) = 13.11$, $p < 0.001$, $\eta_p^2 = 0.13$, as well as a significant effect of the covariate interaction, $F(1.70, 153.19) = 6.77$, $p = 0.003$, $\eta_p^2 = 0.07$. Bonferroni-Holm adjusted post hoc tests showed the same pattern of significance observed in the previous analysis, with statistically significant differences in CAMM scores between t_0 and t_1 , $M_{\text{Diff}} = -2.79$, $t(91) = 3.53$, $p_{\text{Holm}} = 0.001$, $d = 0.37$, as well as t_0 and t_2 , $M_{\text{Diff}} = -3.69$, $t(91) = 4.68$, $p_{\text{Holm}} < 0.001$, $d = 0.49$, but not between t_1 and t_2 , $M_{\text{Diff}} = -0.91$, $t(91) = 1.15$, $p_{\text{Holm}} = 0.25$, $d = 0.12$.

Table 2 Means and standard deviations of CAMM scores

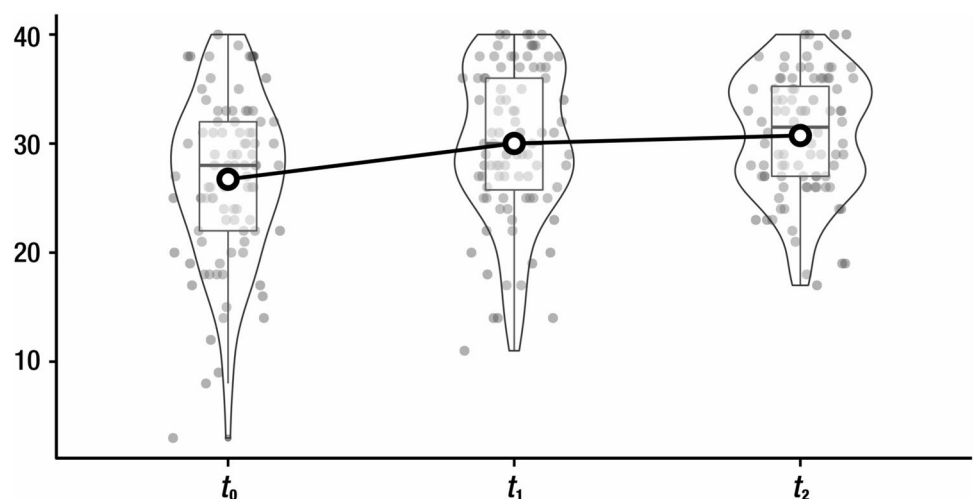
Time point	<i>M</i>	<i>SD</i>
t_0	26.73	7.60
t_1	30.01	7.00
t_2	30.74	5.53

Acceptance Assessment

To examine scale reliability and internal consistency of the acceptance questionnaire, we calculated Cronbach's α and McDonald's omega, and found satisfactory to good internal consistency ($\alpha = 0.891$, $\omega = 0.89$). The correlation between the mean score of items 1–8 and item 9 as an aspect of content validity revealed a high correlation ($r = 0.79$, $p < 0.001$). The participants evaluated the training with an overall grade of $M = 3.52$ ($SD = 1.30$; with 1 indicating the best grade and 6 the worst). With regard to whether the participants liked the exercises, the mean value lay at $M = 4.02$ ($SD = 1.37$; range from 1—*completely* to 6—*not at all*). The mean value for helpfulness was $M = 4.56$ ($SD = 1.29$) and for importance $M = 4.52$ ($SD = 1.24$). In terms of whether participants could use the exercises in their everyday life, the mean score was $M = 5.02$ ($SD = 1.08$).

Furthermore, participants' level of interest in the topic was $M = 4.22$ ($SD = 1.41$), although they showed a high level of understanding of what the training was about ($M = 2.77$, $SD = 1.47$). Overall, participants reported that they felt comfortable during the training ($M = 3.66$, $SD = 1.51$) and were satisfied with how the teacher conducted the mindfulness guidance sessions ($M = 2.90$, $SD = 1.57$). The vast majority of participants (82.72%) reported that they did not pursue mindfulness exercises outside of the training and even more (90.12%) did not currently actively practice mindfulness exercises. In total, 44% would not recommend the training to others, while 28% would do so. The remaining 28% of participants ticked

Fig. 1 Violin plots and box plots for all three measurement time points, calculated in accordance with Patil (2021)—plotting the development of mean inverted CAMM scores from the baseline assessment (t_0) over the mid-intervention assessment (t_1) to the post-intervention assessment (t_2)



the middle area between *recommend* and *not recommend* even though this was not presented as a category to choose.

According to the qualitative evaluation of the open question (“What did you especially like about the training?”, Fig. 2), 37.80% of the participants liked the quiet and relaxed atmosphere during the training. 14.63% of the participants (e.g., “partner exercises”) liked the structure and exercises of 8SAM and 7.32% noted that they liked the cancellation of other classes due to the training. A total of 14.63% expressed criticism regarding the training (e.g., answering “nothing” to this question) and 13.41% reported other aspects (e.g., “the exercises were explained well,” “that one could lie down”). Finally, 20.73% did not answer this question and 8.54% gave multiple answers.

Regarding the second open question (“What did you like less?”, Fig. 3), 21.95% of the students reported that they did not like the atmosphere due to the volume in class or the upright sitting position (e.g., “it was often very noisy,” “many people laughed”). The structure and exercises of 8SAM were disliked by 17.07%, who stated that they were boring. A general rejection of the training was described by

14.63% of participants (e.g., “everything,” “it was unnecessary”). Moreover, 3.66% of the students experienced some exercises as non-voluntary, whereas a further 3.66% found nothing to criticize. Some individual points of dislike are summarized under “other” (13.41%; e.g., “my back hurt,” “it did not help”). Apart from back pain, no other adverse or iatrogenic effects have been reported. Overall, 28.05% of the participants did not answer this question and 3.66% gave multiple answers.

Discussion

The aim of the current study was to assess the efficacy and acceptance of a mindfulness intervention, which was tailored to be integrated into the existing 5th grade curriculum, using a mixed-methods approach. Based on participants’ mindfulness levels as measured by the CAMM, the results provided support for the efficacy and utility of the intervention, although participants’ acceptance of the training was

Fig. 2 Coded and grouped results of the open-ended question regarding what participants especially like about the 8SAM training in percent; more than one answer per participant possible; proportion of multiple answers 8.54%

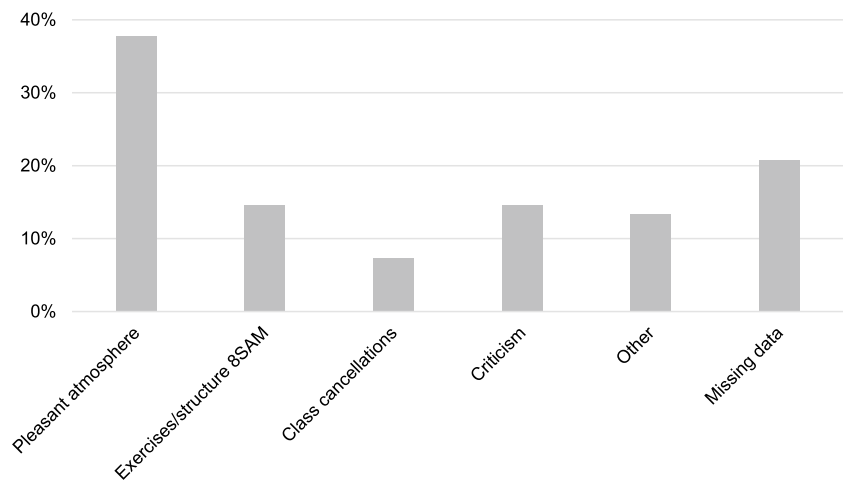
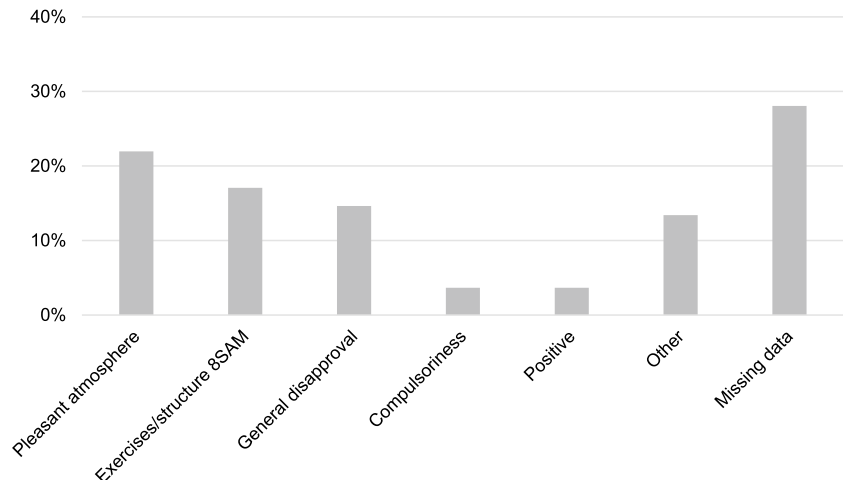


Fig. 3 Coded and grouped results of the open-ended question regarding what participants like less about the 8SAM training in percent; more than one answer per participant possible; proportion of multiple answers 3.66%



moderate. The present findings demonstrated a significant increase in participants' mindfulness compared to baseline scores, with a small to moderate effect size, a very high participation rate, and a low proportion of missing data.

These findings were in accordance with our hypotheses and consistent with previous research reporting that mindfulness-based interventions increase mindfulness in children and adolescents, with a small to moderate effect size (Dunning et al., 2019). After an initial significant increase from baseline (t_0 to t_1), the mean CAMM score further increased slightly, but not significant from t_1 to t_2 . Our study findings were in line with previous studies which likewise report a significant increase in mindfulness from baseline to t_1 with no further improvements after t_1 (Amundsen et al., 2020; Esmaeilian et al., 2018; Laundry et al., 2021). This finding might be explained by a non-linear increase in mindfulness proficiency during the training phase. The effect of the 8SAM training may have manifested itself within the first months, resulting in an increase in mindfulness scores and reaching a significantly saturated level at mid-intervention, after which this level was maintained with no further significant increases.

At the same time, it cannot be ruled out that the efficacy of mindfulness training varies as a function of age (Roeser & Pinela, 2014; Roeser & Zelazo, 2012), with our sample covering only a limited age span (10–12 years). In a meta-analysis investigating the factors determining the effectiveness of MBPs, Carsley et al. (2018) found that intervention success was contingent on age; however, the authors only found significant increases in mindfulness in the subsample of interventions delivered in late adolescence (15–18 years), and not those in early adolescence (11–14 years). In view of our results suggesting that an improvement in mindfulness is also possible in this younger age group, future research should focus on developing trainings specifically tailored to preadolescents' development and needs.

Furthermore, while this increase in mindfulness demonstrated the overall efficacy of the intervention, it also highlighted some challenges associated with measuring mindfulness in children, preadolescents, and adolescents by self-report, as highlighted in a review by Goodman et al. (2017). For example, it is possible that due to a lower capacity for introspection, individuals with less experience of mindfulness had less insight into the nature of their own thoughts and were therefore less likely to reliably report their level of mindfulness. Individuals with greater experience of mindfulness, on the other hand, might had a deeper insight into their mental processes and thus provided more accurate self-reports of lower levels of mindfulness (Grossman, 2011). Paradoxically, therefore, a lack of further significant increases in self-reported mindfulness could actually reflect a greater awareness of one's own thoughts, feelings, and behavior—especially in the case of children, whose metacognitive skills are still developing. In their review, Goodman et al. (2017)

concluded that it would be helpful to integrate self-report measures with third-person, second-person, and first-person (qualitative) assessments. Hence, we will discuss the results of the assessment of acceptance of 8SAM in the section below.

Based on the quantitative and qualitative survey, the overall acceptance of the training was moderate, with almost one in three participants stating that they would recommend 8SAM to others. Upon closer examination of the qualitative survey, it is apparent that around 38% of the participants named the “quiet,” “relaxing,” and “calm” atmosphere as a positive aspect of the intervention. At the same time, however, about 22% of the participants criticized the atmosphere, stating, for example, that “there was a lot of laughing,” “no one cared, it was noisy all the time,” and “some people were looking around and were loud.” Further negative aspects that were mentioned are the required “straight sitting position,” and that it was “uncomfortable.” It is important to note that apart from “back pain” no other adverse and iatrogenic effects were mentioned. Only a minority of participants reported the cancellation of regular classes in order to attend the intervention as a positive factor, and a small number of participants criticized the compulsory attendance of the intervention.

Regarding the structure and exercises of 8SAM, participants criticized the exercises as being “boring,” “unnecessary,” and “unhelpful,” and one participant specifically found fault with the “breathing exercises.” In contrast, participants explicitly liked the “partner exercises,” the “cooperation,” “practical exercises,” and “playing games.” In addition, the teachers who delivered the intervention provided very good verbal feedback on the training in terms of feasibility and the perceived effects among the participants. As a consequence, 8SAM was implemented into the regular school curriculum after the completion of study.

As a further potential reason for the moderate acceptance rates despite the good efficacy, participants may have felt obligated to actively participate since the mindfulness exercises were embedded into the school curriculum and conducted in regular lesson times, despite the fact that participation in the exercises was voluntary. Previous research found that mindfulness training may not appeal equally to all participants, and has a greater impact when participation is voluntary (Aherne et al., 2016; Roulston et al., 2018). While these effects may be attributed to a self-selection bias, this discrepancy nevertheless underlines that when developing mindfulness trainings, it may be important to include aspects that foster motivation and engagement.

Finally, the only moderate acceptance by the students, especially when considering the positive efficacy outcomes, appears to be particularly important as it raises the question of whether and in which way the teaching and practice of mindfulness for preadolescents and adolescents should be modified in order to address barriers to implementation and student engagement, which has already been discussed by

previous authors (Carsley et al., 2018; Strohmaier & Bailey, 2023). Our results support the need to tailor mindfulness practices to be developmentally appropriate, as recently postulated by Johnson et al. (2024). In the implementation of MBPs in schools, the authors highlight various possible barriers (e.g., “classroom structure and lay facilitators,” “emotion regulation and metacognitive capacity,” and “relevance and competing demands”) which can be both structural and developmental. Foulkes and Stapley (2022) recommended focusing on gathering qualitative data about how students themselves experience the MBPs. Traditional approaches to mindfulness teaching rely mostly on contemplative practices such as breathing exercises in particular body positions. It may be the case that more active practices such as balancing postures or partner exercises would be more accepted by younger adolescents, especially when introducing mindfulness. This seems especially relevant since some authors have already discussed students’ individual motivation as a barrier with regard to the positive effects of MBPs (Bogaert et al., 2023) and at the same time a low frequency of home practice was observed in several studies (Tudor et al., 2022), which was also found in the current study. Compared to adults, young adolescents’ motivation to actively participate may have a greater impact on efficacy, which may be enhanced by shorter practices with a more active experience-based focus.

Limitations and Future Directions

The present study had several limitations. First, since the aim of the study was to investigate feasibility, a pre-post design was used. To control for further potential confounding effects, randomized controlled study designs may be favorable in future research. Second, teachers’ pre-intervention mindfulness workshop comprised 1 day of training focusing on concepts and theories underlying 8SAM as well as its implementation in the classroom. The extent of the training workshop might be comparatively sparse. Therefore, the following three adjustments might enhance the quality of the overall program in this regard: (a) expanding the extent of the workshop, (b) assessing the success of the workshop by evaluating the teachers’ understanding of mindfulness concepts and theories, and (c) measuring teachers’ level of mindfulness and one’s own mindfulness practice. Participation in the mindfulness intervention was voluntary and participants were allowed to quit the intervention at any given point in time.

When students were asked, what they liked less, only one physical adverse effect (back pain) was spontaneously mentioned, whereas no other iatrogenic effects were reported. One other study reported iatrogenic effects via quantitative measures as a worsening of depressive symptoms in a subgroup of students with elevated health symptoms, but did not use a qualitative approach (Montero-Marín et al., 2022). In addition to efficacy, future studies of school-based mindfulness

trainings should include measurements of iatrogenic effects (e.g., perceptual, affective, somatic, and cognitive impairments) as standard (Cebolla et al., 2017; Van Dam et al., 2018). In a more structured approach, students could be asked about the possibility of having experienced any kind of adverse or unwanted effects (dichotomous item: *yes/no*). If the answer is “yes,” they could be encouraged to further describe in detail the specific individual experiences, the setting in which they occurred (e.g., in individual or group practice at school or while practicing mindfulness at home), and the type/duration of mindfulness practice using a qualitative approach with open-ended questions. In addition, one further limitation is that only students from one school grade in one gymnasium in Rhineland-Palatinate were examined, which limits the ability to transfer the findings to other school grades and school types.

Besides these limitations, which partly result from the character of a feasibility study, several strengths of the study can also be mentioned. To the best of our knowledge, very few studies have examined mindfulness in preadolescents over such a long period of time. Moreover, the participation rate in the present study was very high (Galea & Tracy, 2007), with a low proportion of missing data, and the results revealed a significant increase in mindfulness over time. Further strengths lie in the manualized implementation of the training as well as the training and supervision provided to the teachers delivering the intervention throughout the study. Overall, the structure of the training makes it easy for teachers to implement it on their own. The verbal feedback from the teachers was very positive in terms of feasibility and effects on the participants, which led them to continue the mindfulness exercises independently in the following school years.

As a further strength of the study, we used a high-quality instrument to assess self-reported mindfulness, which is widely applied in the English-speaking area and is characterized by its high efficiency. In the meantime, Baumann et al. (2022) have validated a German version of the Child and Adolescent Mindfulness Measure in a community sample (10–19 years). The two German versions show a high correspondence regarding the item wording as well as psychometric parameters (e.g., Cronbach’s $\alpha=0.83$, McDonald’s omega $\omega=0.85$). Accordingly, our translation achieved psychometric values that were comparable to the original version by Greco et al. (2011) in terms of factor structure and internal consistency, thus demonstrating robust psychometric properties. Negative correlations between the German CAMM and the BSCL demonstrated the German CAMM’s divergent validity, and these results were by and large consistent with previous findings (Bergomi et al., 2013; Böge et al., 2020; Gaiswinkler & Unterrainer, 2016). A major strength of the study was the incorporation of an extensive qualitative survey on the acceptance of the training. With a very good participation rate, these findings provide important new insights into mindfulness in children and should inform the development of future mindfulness trainings.

The presented results indicate that mindfulness might be effective in regular school schedules and delivered in classes. There is a broad consensus that mindfulness trainers should have their own experience of mindfulness and practice it regularly (Kenny et al., 2020). Similarly, an instructor's experience regarding mindfulness has been found to be positively associated with the success of the intervention (McKeering & Hwang, 2019). To take advantage of this “practice what you preach” effect, future research should focus on more standardized training for teachers, analyze preexisting mindfulness experience and the relationship with the concept of mindfulness in trainers, and conduct precise investigations of adherence. With this in mind, future research should also address the question of how training for teachers can be designed to prepare them well for implementing mindfulness trainings in schools in order to further increase effectiveness and to derive the best benefit from the teacher's existing competencies (e.g., didactic skills). In addition, teachers who are themselves exposed to high stress levels—especially in the context of the shortage of teaching professionals in Germany (Kollerová et al., 2023; Unterbrink et al., 2008)—could receive support in the form of a regular mindfulness practice. As such, the ultimate aim is to make the classroom a place of daily well-being and the school a space for efficient learning in the long term.

Besides overcoming methodological issues, a more in-depth understanding of the target population seems warranted. Based on our results, it seems that mindfulness training may have some benefits in preadolescents attending the 5th grade, but the didactic nature of the implementation may have reduced the effects. Focus groups, or at least qualitative interviews with preadolescents, might lead to a better understanding of the optimal didactic delivery of mindfulness in this age group. Indeed, experience-based focus groups, incorporating a broad range of mindfulness exercises and subsequent discussion of acceptance and usability in everyday life, may give rise to in-depth guidance on didactic presentation and enhanced efficacy.

Appendix

Bitte kreuze an, wie sehr Du den einzelnen Aussagen zustimmst. Beziehe Dich dabei auf das gesamte Training.

1. Das Thema des 8SAM-Trainings hat mich interessiert.
2. Die Übungen, die wir kennengelernt haben, sind wichtig für mich.
3. Ich habe verstanden, worum es bei den Übungen ging.
4. Die Übungen haben mir gefallen.
5. Die Übungen, die wir kennengelernt haben, helfen mir.

6. Die Übungen, die wir kennengelernt haben, kann ich auch im Alltag nutzen.
7. Ich habe mich während des Trainings wohl gefühlt.
8. Ich bin zufrieden damit, wie mein Lehrer das Training durchgeführt hat.
9. Wenn man alles in einer Schulnote zusammenfassen könnte, würde ich dem Training 8SAM folgende Note geben:
10. Hast du außerhalb des Trainings Achtsamkeitsübungen gemacht?
11. Machst du aktuell noch Achtsamkeitsübungen?
12. Ich würde 8SAM anderen Schülerinnen und Schülern weiterempfehlen:
13. Was hat Dir an dem Training besonders gut gefallen?
14. Was hat Dir weniger gefallen?

Item 1 – 9: voll und ganz (1), sehr (2), weitgehend (3), teilweise (4), wenig (5), gar nicht (6)

Item 10 – 11: nie (1), manchmal (2), regelmäßig (3)

Item 12: ja (1), nein (0)

Item 13 – 14: offenes Antwortformat

Please mark how much you agree with each statement. Please refer to the entire training.

1. I found the topic of the 8SAM training interesting.
2. The exercises we learned are important for me.
3. I understood what the exercises were about.
4. I liked the exercises.
5. The exercises we learned help me.
6. I can also use the exercises we learned in my everyday life.
7. I felt comfortable during the training.
8. I am happy with how my teacher carried out the training.
9. If I could summarize everything into one school grade, I would give the 8SAM.
10. training the following grade:
11. Did you practice mindfulness exercise outside of the training?
12. Do you currently still do mindfulness exercises?
13. I would recommend 8SAM to other students:
14. What did you especially like about the training?
15. What did you like less?

Item 1 – 9: completely (1), very (2), mostly (3), partly (4), a little (5), not at all (6)

Item 10 – 11: never (1), sometimes (2), regularly (3)

Item 12: yes (1), no (0)

Item 13 – 14: open response format

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Vanessa B. Wolter: conceptualization, software, methodology, writing—original draft preparation.

Jasmina Eskic: conceptualization, writing—review.

Florian Hammerle: conceptualization, methodology, formal analysis and investigation, writing—original draft preparation, writing—review and editing, project administration and supervision.

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Data Availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics Approval The study was carried out in accordance with the Declaration of Helsinki and approved by the State Medical Chamber of Rhineland-Palatinate (Landesärztekammer Rheinland-Pfalz), the Controlling and Service Directorate for schools in Rhineland-Palatinate (Aufsichts- und Dienstleistungsdirektion; ADD), and additionally local commissioner for data protection (University Medical Center of the Johannes Gutenberg University Mainz).

Informed Consent For the informed consent procedure, first, all participants and caregivers were provided with written information about the study and the training. Second, an evening parent meeting was held, in which information about the concept of mindfulness in general and the aims of the study in particular was provided, and parents/guardians were able to ask questions. Written informed consent was obtained from all participants and their parents/legal guardians prior to study inclusion.

Conflict of Interest The authors declare no competing interests.

Use of Artificial Intelligence AI was not used.

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