Promoting Psychological Well-being in Preschoolers Through Mindfulness-based Socio-emotional Learning: A Randomized-controlled Trial

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Abstract

Mental health issues in children and young people are frequent and can have enduring negative consequences. Preventive early interventions delivered at school may foster psychological well-being, and preliminary evidence suggests that mindfulness-based social and emotional learning (SEL) interventions have positive effects on children's mental health. The aim of this study was to evaluate a mindfulness-based SEL curriculum including a French adaptation of the Kindness Curriculum, delivered by pre-kindergarten teachers, in a cluster randomized controlled trial. Sixty-four classes (761 children aged 38-58 months, 52.7% girls) from a socio-economically disadvantaged area in France were randomly assigned to either intervention or control conditions. Indicators of children's mental health, self-management, positive relationships with teachers and peers, emotional processing and executive functioning were collected through teacher-rated questionnaires, masked standardized observations, and

behavioral tasks. Results in the whole sample indicated a positive effect of the intervention on children's mental health, including a reduction in emotional, conduct and peer relationship problems, and a reduction in teacher-child conflicts. No significant effects were found on the other indicators. Heterogeneity analyses revealed stronger effects of the intervention on several indicators for children who had a teacher with lower level of teaching experience, for children with lower baseline mental health and for older children. This program therefore appears as a promising early school-based intervention promoting mental health and positive relationships, especially in a subgroup of at-risk preschool-aged children.

Keywords

Social and emotional learning; Mindfulness; Preschool; Mental Health; Psychological well-being, Teacher-child relationship

Public significance

This study found that a mindfulness-based social and emotional learning intervention implemented by preschool teachers in France in a socio-economically disadvantaged area promotes children's psychological well-being and reduces teacher-child conflicts.

Introduction

Rates of emotional problems in children and young people have increased over the past thirty years in Western countries, with a recent peak due to the COVID-19 pandemic (Collishaw, 2015; Nearchou et al., 2020). In the US, prospective cohort data showed that 82.5% of the youth population will have met diagnostic criteria for a mental disorder by age 21, making mental health issues in youth the rule rather than the exception (Copeland et al., 2011). Most mental disorders found in the adult population have onset during childhood or adolescence, indicating that a significant part of these issues are more than transient phenomena (Solmi et

al., 2022). Long-term negative effects of mental health issues on academic achievement, employment and quality of life are well-established (Doran & Kinchin, 2017; Pagerols et al., 2022). Given their prevalence and prevailing impact, validating and disseminating preventive interventions for mental health issues in children and youth is currently considered by leading world health authorities as a priority, if not an emergency (American Academy of Pediatrics et al., 2021; Solmi et al., 2022).

School-based mental health support systems

Children and adolescents spend most of their waking time at school on weekdays, making the school setting both a crucial and preferential context for mental health prevention (Weist et al., 2023). Multi-tiered systems such as the three-tier model offer a conceptual framework to organize and tailor school-based mental health support systems to face the needs of each child at different levels of intensity (Shepley & Grisham-Brown, 2019). Tier 1 represents universal prevention and includes strategies for promoting psychological well-being in all students. Tier 2 involves targeted interventions for students at risk of developing mental health issues, providing early group or individualized support within schools. Tier 3 focuses on intensive interventions for students with severe and persistent mental health concerns, offering specialized treatment and services. By addressing mental health needs at each tier, the 3-tier model aims to create a comprehensive and inclusive school environment that supports the mental health of all students.

Promoting children's psychological well-being at tier 1

According to the PERMA framework, psychological well-being depends on five core subjective components: Positive emotions, Engagement, Positive relationships, Meaning, and Accomplishment (Kern et al., 2015). Prevention science suggests that school environments

nurture psychological well-being when toxic social interactions are minimized while prosocial behaviors are taught and reinforced (Biglan et al. 2012). Furthermore, at the individual level, research emphasizes the importance of emotional, relational, and cognitive/attention self-regulatory skills for psychological well-being (Bailey & Jones, 2019; Eisenberg, 2006; Liew & Spinrad, 2022). Early interventions targeting self-regulatory skills and prosociality within classes may promote positive emotions, positive relationships, engagement and accomplishment, and may therefore have a unique impact on children's mental health while also supporting school achievement (Blair & Raver, 2015). These self-regulatory and social skills are targeted by social-emotional learning (SEL) interventions which aim at developing social and emotional competencies in children and adolescents: self-awareness, self-management (also referred to as "self-regulation"), social awareness, relationship skills and responsible decision making (CASEL, 2003).

The effects of MBIs interventions in preschool-aged children

Mindfulness-based interventions (MBIs) are systematic mental training protocols that target three key self-related processes: self-awareness, the ability to be aware of one's inner life ; self-management, the ability to effectively manage or alter one's responses and impulses, and self-transcendence, the development of a positive relationship between self and others that transcends self-focused needs and increases prosocial characteristics (Vago & Silbersweig, 2012). Mindfulness practice encourages self-management in challenging social situations, perspective taking and awareness of others' experiences and needs (Brown et al., 2007). In a recent meta-analysis examining the efficacy of different types of psychological interventions supporting psychological well-being in adults, MBIs displayed the largest effect sizes both in non-clinical and clinical populations (van Agteren et al., 2021).

In children and adolescents, one recent systematic review of school-based MBIs studies reported positive effects on prosocial behavior, executive functioning, attention, and mindfulness, and decreased anxiety, attention problems/ADHD behaviors, and conduct behaviors (Phan et al., 2022). Nevertheless, in line with previous literature reviews, it was noted that available studies of MBIs in school-aged children are characterized by important methodological limitations: most studies were conducted in small samples, few integrated independent masked observer ratings, few investigated the impact of MBIs on externalizing behaviors, and most studies were devoted to testing new mindfulness-based protocols rather than replicating previous findings (Phan et al., 2022). In preschool-aged children (3-5 years old) more specifically, the current evidence-base for MBIs can only be considered preliminary, as the limited number of studies available present a methodological risk of bias, with a majority presenting a high level of risk (Sun et al., 2021).

The Kindness Curriculum

In preschool settings, one of the available MBIs with the strongest evidence-base is the Kindness Curriculum, a sequence of lessons designed to increase self-awareness, self-management, and self-transcendence in 3–5-year-old children through breathing and movement exercises, games, music, and reading activities (Poehlman-Tynan et al., 2016). The Kindness Curriculum was evaluated in two previous cluster randomized controlled trials (RCT) conducted by the same research institution in the United States. Positive effects were found on prosocial behaviors, emotion regulation, sharing behaviors, and cognitive flexibility compared to a wait-list control group in a total sample of 70 children (Flook et al., 2015), and for attention control and self-management in a total sample of 29 economically marginalized children (Poehlman-Tynan et al., 2016). Each time, the program was delivered by specialized instructors over 12 weeks.

Despite being promising, evidence for Kindness Curriculum's impact currently relies on two studies conducted in small samples, with limited statistical power and no pre-published data-analysis plan. At the statistical level, adjustment for clustering of standard errors was not applied, which may bias estimates of intervention effects (Abadie et al., 2017). Furthermore, while intervention delivery by specialized instructors may foster implementation quality, it represents a costly approach that is difficult to deploy and structure as a universal primary mental health prevention strategy. Intervention delivery by trained school teachers represents a less costly and possibly more realistic option to reach rapidly countrywide dissemination. MBIs are generally considered feasible and acceptable by school teachers (Bockmann & Yu, 2022), and delivery by teachers was found to promote children's academic achievement, behavioral adjustment at school and positive teacher-child relationships (Blewitt et al., 2020; Cipriano et al., 2023). As for other material, teaching mindfulness-based socio-emotional content may also have learning benefits for the teachers themselves (Kobayashi, 2019), by improving their self-care strategies and influencing their personal well-being. Changes in teacher's emotional well-being and attitudes may in turn have positive effects on teacher-student relationships (De Carvalho et al., 2021).

The current study

In sum, there is currently a need to improve the evidence-base for early psychological well-being promotion interventions in preschoolers through replication studies with minimal risk of methodological bias, and the Kindness Curriculum represents a promising MBI that deserves further investigation. As the program has only been tested in the United States, replication of previous study findings in another cultural context is important to strengthen its evidence-base. In France since 2016, supporting SEL is recognized as one of the key missions of the National

Education department (Lamboy et al., 2022). Nevertheless, evidence-based programs evaluated in the national context are currently lacking.

In the present study, we set out to rigorously evaluate a mindfulness-based SEL curriculum delivered by trained teachers in French preschools. Given the strong association between socio-economic status and self-management (Ng-Knight & Schoon, 2017) as well as psychological well-being (Poulain et al., 2019), this intervention was implemented and evaluated in a predominantly socio-economically disadvantaged French department (poverty rate around 25-30% between 2017 and 2021, compared to a national average of 14-15%). Effects of the intervention on students' mental health, behavior regulation, prosocial behaviors, emotional processing, student-teacher relationships, and executive functioning were investigated, using teacher-rated questionnaires, as well as masked standardized observations and experimental tasks. Analyses were pre-registered (Courbet et al., 2022). We hypothesized that the intervention would lead to more favorable outcomes on collected measures after 24 weeks of program exposure. Given the existing bi-directional associations between children's social and emotional competencies and teacher well-being (De Carvalho et al., 2021; Haldimann et al., 2023; Narea et al., 2022; Jennings & Greenberg, 2009), analyses were performed to explore the potential impact of the intervention on teachers' well-being. We also investigated teachers' satisfaction and motivation to implement the program. Heterogeneous effects were also explored by conducting subgroup analyses based on child-level and teacher-level indicators (Courbet et al., 2022): we hypothesized that when exposed to the intervention, children with low mental health at baseline or high conduct problems at baseline (Carroll et al., 2020; Flook et al., 2015; Viglas & Perlman, 2018), boys (Coelho et al., 2015; Low et al., 2019), older children (Blewitt et al. 2018) and children having a teacher with low teaching experience will display more progress on the measured outcomes.

Methods

Participants' recruitment

The study protocol has been described in detail previously (Courbet et al., 2022). Preschool teachers were recruited from public schools in sixteen municipalities of the Seine-Saint-Denis (93) French department. Information about the trial was sent to teachers and school principals through emails and oral presentations between April and June 2021. Interested teachers were then asked to contact the principal investigator [TV] by email for recruitment.

To be included in the study, teachers had to teach Pre-K level children, or a mixture of Pre-K and kindergarten level (corresponding to *Moyenne Section*, or *Moyenne + Grande Section* in France). When teachers taught a mixture of Pre-K and kindergarten level children, only Pre-K level children were included in the present study. Exclusion criteria at children level included parent refusal for the child to participate, or consent withdrawal during the study. To ensure that experimental data collection would be feasible, specific exclusion criteria were added for experimental tasks: 1) children showing comprehension difficulties in French language, 2) children who did not speak French or had high difficulties in expressive French language, (3) children with suspicion of neurodevelopmental disorders (e.g., intellectual disability or autistic spectrum disorders); and (4) children with severe behavior problems (e.g., high aggression/tantrum level). To avoid mistakes and facilitate collaboration with teachers during the school visit days (which combined experimental and observational data collection by trained examiners), children who were excluded from the experimental data collection based on the 4 criteria were also excluded from the observational data collection.

Teachers sent parents information letters explaining the study objectives and detailing the children's participation. Consent-refusal forms were attached to the letter, so that parents could return the form to the teacher if they did not consent for their child to participate. Teachers then

informed investigators [OC, TV] of parent refusal. Oral consent was also obtained from children before experimental task data collection. The procedure was approved by the Paris-Lumières ethics committee of the UFR SPSE, Psychological and Educational Sciences (reference number: 04-n°1).

Randomization

We performed cluster-design power calculations and considered the various parameters that could affect the sample size required to detect a minimum detectable effect size (MDES) of 0.35 standard deviation (Bloom, 2006; Murano et al., 2020). Overall, to reach such an MDES, we needed to recruit at least 55 classes (considering 10 children per class, 20% of attrition, and an intra-cluster correlation coefficient set at 0.20). A total of 64 preschool classes from 50 schools were recruited, with 34 classes composed of only Pre-K students and 30 classes with a mixture of Pre-K and kindergarten-level students.

At the beginning of the school year (September 2021), classes were randomly allocated to either the intervention group or a wait-list control condition. We stratified our sample by classroom type: for the 34 Pre-K classes, 17 classes were allocated to the intervention group, and 17 to the control group. For the 30 PreK+Kindergarten classes, we assigned 15 classes to the intervention group and 15 classes to the control group. Overall, 32 classes were allocated to the treatment group, and 32 classes were allocated to the control group. A maximum of 12 children were selected within each class for observations and experimental tasks, and a maximum of 16 children per class were assessed with teacher-report questionnaires. Children participating in the study were randomly selected from students' lists by an investigator [OC].

Allocation sequence was generated by one of the principal investigators [TV]. Children's assessments were carried out by certified evaluators who were masked to study objectives and

group allocation (i.e., did not know about objectives and allocation). Masking was verified at the end of the school year by sending questionnaires to evaluators asking whether they could guess what the study topic was, and if they could identify what the classes' conditions were. No evaluator was able to describe the study topic or identify the classes' conditions.

Procedure for data collection

Children's measures (teacher-report questionnaires, observations and tasks) were collected both before (T0) and after intervention (T1). Self-report data assessing teachers' characteristics were collected at T1.

At T0 (Oct. 2021), electronic forms with questionnaires assessing children's baseline outcome variables were completed by teachers. Masked evaluators followed a 3-day training for running experimental tasks (1 day) and for using the Individualized Classroom Assessment Scoring System (inCLASS; Downer et al., 2010) (2 days; Oct. 2021). For the experimental tasks, training included presentation of each task and role-playing in groups of 4 (2 evaluators, 1 "child" and 1 observer). For the inCLASS tool, training consisted of a detailed presentation of each dimension of the tool combined with watching, commenting, and coding training video clips. Then, evaluators were assessed for reliability in running tasks by [OC] and a research assistant. They were also certified for the inCLASS tool, following the certification procedure of the inCLASS developers (Downer et al., 2010): evaluators were required to code five reliability video clips independently, and code within one point of a master code on at least 80% of the dimensions to be considered reliable. Inter-rater reliability at T0 and T1 was in the same range as previous studies (Suppl 2) (Bohlmann et al., 2019; Downer et al., 2010; LoCasale-Crouch et al., 2018).

Following evaluators' certification, baseline children's observations and experimental tasks were carried out in school (Oct-Nov. 2021). Evaluators worked in pairs and spent approximately 3 days per school to assess 8 to 12 children. Each morning, 4 inCLASS observation cycles for 3-4 children were carried out by pairs of evaluators (2 cycles each), and afternoons were dedicated to run all experimental tasks for 3-4 children. During sessions, tasks were administered in the following order: executive function tasks, peer acceptance task, sharing task, challenging situation task, and emotion matching task.

After intervention (T1; May-June 2022), a second wave of assessment using teacher-rated questionnaires, observations in class, and tasks were carried out following the same procedure. Before endline assessment, masked evaluators received a 4-hour training supplement with reminders about tasks and inCLASS dimensions, and coded and discussed a new inCLASS training clip (May 2022). Questions related to teachers' characteristics were also completed by teachers at T1.

Implementation fidelity was reported using two different procedures. First, teachers in the intervention group wrote in a standardized notebook the activities implemented each day, their durations, and their comments if necessary. Second, teachers audio-recorded themselves using a recording device while implementing some activity sessions in the middle of the school year. In total, two sessions per activity type (Kindness Curriculum, body-oriented activities and emotion circle) were recorded and transferred to a principal investigator [OC]. Records were then double-coded by two trained independent evaluators based on the following criteria: 1) compliance with the activity/lesson objectives, 2) compliance with the structure and content of the activity, 3) appropriate teacher posture and attitude during the lesson. Each question was coded using a 4-point Likert scale from 0 to 3 (with 0 = "not respected at all" and 3 = "totally respected"). 95.7%, 96.4% and 94.2% of inter-rater agreement (1-point difference maximum between the two evaluators) was reached for each criterion, respectively.

Conditions

Intervention

Teachers in the intervention group were trained for 2 days (Nov. 2021). Training was provided by 1) a principal investigator [TV] specialized in cognitive behavioral therapy, including mindfulness; 2) [VK], a yoga instructor; and 3) a teacher experienced in implementing yoga-inspired body-oriented activities in the preschool context. Training included the presentation of each activity, role-playing, and personal initiation to body-oriented exercises and mindfulness. Teachers received the required materials and detailed instruction manuals for each activity. Then, teachers implemented the program for 24 weeks (Nov 2021 to June 2022). The intervention is composed of a set of three activities: 1) a progressive mindfulness-based SEL curriculum (i.e., a French adaptation of the Kindness Curriculum; see Suppl 1), 2) body-oriented ritualized activities, and 3) a ritualized emotion circle time. Teachers were asked to devote 15-20 min each school day to the program content (approximately 30 hours in total over the school year). Description of each activity is available in the Supplementary materials section (Suppl 1).

Control group

Teachers allocated to the control group carried on their normal academic activities, and were given access to the program training and materials during the following academic year (Sept. 2022). Of note, as they moved to the next school level, students of teachers in the control group of this study did not receive the intervention the following year. Social and emotional competencies are not directly targeted by French academic programs. However, some teachers in the control group may decide to independently implement other activities targeting psychological well-being or social and emotional competencies. To control for this possibility,

teachers were asked at the end of the year to report any activity implemented in their class that targeted these components. Thirty teachers responded in the control group, and 29 in the intervention group. Only one teacher (3%) in the control group implemented activities that shared strong similarities with the program, including conflict management, controlled breathing, and mindfulness inspired components (focusing on external sounds), on a regular basis, while 6 teachers (20%) in the control group implemented one or two components that were similar to components of the intervention (e.g. books based on emotion recognition, emotion expression, or conflict management techniques…), usually not on a regular basis. In comparison, only 4 teachers (14%) in the intervention group occasionally implemented, in addition to the program, other activities that shared one or two components with it. These teachers were not excluded and remained in their respective group.

Measures

Detailed description of each measure is available in Suppl 2.

Teacher-report questionnaires were used to collect demographic questions (children's age and gender) and assess children's behaviors and teacher-child relationship. First, the French version of the *Preschool and kindergarten behavior scale (PKBS)- Social skills* (Merrell, 1996) displays a five-factor structure (*social interaction, agreeableness with peers* and *autonomy, compliance* and *cooperation with peers),* excellent internal consistency and adequate construct validity (Courbet et al., 2024). The *Student-teacher relationship scale-short form* (STRS) assesses closeness and conflict between teacher and students. Its original and French version displays adequate to excellent internal consistency and construct validity (Courbet et al., 2024) (Pianta, 2001). Finally, the *Strengths and Difficulties questionnaire (SDQ)-extended teacher version* measures emotional symptoms, conduct problems, hyperactivity-inattention, peer

problems, prosocial behavior and impact of difficulties (Goodman, 2001). The original and French versions of the SDQ display satisfactory reliability and validity (Capron et al., 2007; Goodman, 2001).

Self-rated measures were also used to measure teachers' well-being: the *Comprehensive inventory of mindfulness experience* (CHIME) measures trait mindfulness and exhibits good reliability and satisfactory construct validity (Bergomi et al., 2014). The *Warwick-Edinburgh Mental Well-Being Scale* (WEMWBS) evaluates hedonic and eudaimonic well-being, satisfying personal relationships and positive functioning (Tennant et al., 2007). Both original and French versions display good psychometric properties (Tennant et al., 2007; Trousselard et al., 2016). The *Satisfaction with professional life scale* (« *Échelle de Satisfaction de Vie Professionnelle* »; ESVP) is French self-report measure of general professional life satisfaction that demonstrates an adequate internal consistency and temporal stability, and good construct validity (Fouquereau & Rioux, 2002). A commitment scale was also designed for use in this study to measure teachers' satisfaction and commitment to implement the program. It displayed adequate internal consistency (Suppl 2).

Questionnaires assessing children's behaviors were completed by standardized observations of children and by a set of experimental task measures. Observations were conducted using the *inCLASS* observation tool assessing children's positive engagement with teachers, positive engagement with peers, positive engagement with tasks, and negative classroom engagement. It displays solid inter-rater reliability, construct validity, and criterion validity (Downer et al., 2010). Experimental tasks were the following: the *Challenging Situations task* (CST) is a pictorial choice measure of children's emotional and behavioral responses to hypothetical challenging interpersonal situations (Denham et al., 1994). The *Emotion matching task-expressive knowledge* assesses children's ability to recognize and label others' emotional expressions. It demonstrated good criterion validity, strong reliability and construct validity

(Morgan et al., 2009). The *Peer acceptance task* is a peer rating measure of the extent to which a particular child is accepted and liked by his peers that shows adequate reliability and validity (Bossaert et al., 2011). Finally, we used three tests of the executive functioning battery "*EF Touch*" measuring working memory and cognitive flexibility. The battery displays good criterion validity (Willoughby et al., 2012) (Suppl 2). Both standardized observations and tasks were run by masked evaluators.

Data analyses

Data were analyzed using Stata version 17 (Statacorp, 2023) and Jamovi version 2.3 (The jamovi project, 2023). To estimate intervention's effects at children and teacher levels, we first ran an OLS regression of each measured outcome on a dummy variable indicating whether the teacher was assigned to the intervention. In a second model, a vector of pre-determined covariates that are unaffected by the treatment was added to the model following the post-double selection Lasso method as in Belloni et al. (2014). We considered children's gender, children's level of outcome variables at baseline, teachers' level of experience, teachers' age, and multiclass level as covariates. A third model controlled for spillover effect, i.e., the fact that in schools with some teachers in the control group and some teachers in the intervention group, some of the control group could have benefited from the intervention contents. In practice, we run the same estimation after excluding the schools where there was a potential for such spillovers.

For each estimation, we clustered the standard errors at the unit of randomization (class). Estimating the effect of an intervention on several outcomes raises multiple testing issues. Following Anderson (2008), we first group outcomes into families (Table 1) and, in each family, we construct the so-called standardized treatment effect, with weights accounting for

the variances and covariances of the outcomes, in order to maximize the information captured by the weighted average. Second, within each family, we adjusted the p-values of each estimated effect for control of the False Discovery Rate (FDR), following the step-up procedure developed in Benjamini & Hochberg (1995).

*[insert **Table 1** here]*

Within each family, both the unadjusted p-value of the coefficient of the treatment variable and the p-value adjusted for control of the False Discovery Rate were computed (Benjamini & Hochberg, 1995). Finally, to assess heterogeneous effects, we conducted moderation analyses by interacting the treatment status to a moderation variable. We used five moderation variables: i) gender: boys (girls), ii) baseline mental health issues, as measured by the SDQ total score, iii) conduct problems at baseline, as measured by the SDQ conduct problems score, iv) age of the child in months, and v) teacher experience: having a teacher with less than five years (more than five years) of teaching experience. Suppl 9 only presents the coefficient of interest that is associated with the interaction between the treatment status and the moderation variable.

Transparency and openness

We report how we determined our sample size, all data exclusions, and all measures in the study, and we follow JARS (Kazak, 2018). All data, analysis code, and research materials are available on demand. This study's design and its analysis were pre-registered (Courbet et al., 2022).

Results

Balancing and attrition

No significant differences were found between the two conditions on any control variable, and outcome variable at baseline (Suppl 3A and Suppl 3B). Attrition rates for the control and treatment groups did not differ significantly for questionnaire measures (Suppl 4). For observational and experimental outcomes, at variable level, differential attrition was found between intervention and control conditions between baseline and endline for 3 tests, for which attrition was increased in the control group compared to the intervention group: inCLASS responses at endline (4 variables; p = .017), emotion matching task scores (p = .017), and executive function tasks responses at endline (3 variables; p = .003).

Descriptive statistics and correlation analyses

Teachers and children characteristics are presented in Table 2.

*[insert **Table 2** here]*

Correlations between outcomes were examined within families and were in the expected direction (Suppl 5).

Commitment and implementation fidelity

Eighty-six to 93 percent of teachers agreed or strongly agreed with each of the sentences evaluating satisfaction and motivation to implement the program (Suppl 6). Satisfaction toward training as well as children's satisfaction with the program were moderately correlated with motivation to implement (r = .40, p = .007; r = .60, p < .001 respectively). Mean commitment

score (including satisfaction and motivation) was high (*M* = 4.56; *SD* = .41). Concerning the time dedicated to each activity, teachers dedicated on average 28.70 hours (*SD* = 10.20) to program implementation (Suppl 7). Heterogeneity was high, with a minimum of 9.60 hours to a maximum of 49.00 hours in total. Teachers spent more hours implementing the Kindness Curriculum (*M* = 12.48 hours; *SD* = 4.39) and body-oriented activities (*M* = 9.69; *SD* = 4.80) compared to emotion circle time (*M* = 6.51 hours; *SD* = 3.91).

High fidelity to the objectives, structure and content of activities, and expected teacher posture was reported by evaluators when coding audio-recordings. Average scores across the three components were all between 2 ("mostly respected") and 3 ("totally respected") for objectives, structure/contents, and teacher posture (*M* = 2.70, *SD* = .50; *M* = 2.50, *SD* = .70; *M* = 2.7, *SD* = .50, respectively). No teacher had an average score below 1 (= "somewhat respected") for one component, and only one teacher had an average score across the three components between 1 (= "somewhat respected") and 2 (= "mostly respected").

Intervention effects on teacher well-being

We did not detect any significant effect of the intervention on teacher mindfulness, mental well-being, and professional life satisfaction (Table 3).

*[insert **Table 3** here]*

Intervention effects on children's outcomes

Control for spillover effect

There were no major differences considering the effect of the intervention between the regression run with the second model with a control variable and the regression run with the third model that considered the sample without spillover. Results for the third model without spillover are available in Suppl 8.

Intervention effects in the whole sample

A significant positive effect of the intervention was found for mental health issues (d = 0.27; p < .001) as a whole. Within-family effects were found for SDQ emotional problems (d = 0.24; p = .005), SDQ conduct problems (d = 0.15; p = .019), SDQ peer relationship problems (d = 0.29; p = .006) and STRS conflict (d = 0.18; p = .021) (Table 4). Scores for SDQ emotional problems and conduct problems decreased in the intervention group while they remained stable in the control group. For the SDQ peer relationship problems, scores decreased in both groups but showed a larger decrease in the intervention group. STRS conflict score decreased in the intervention group while increasing in the control group. No other significant effect was found in the whole sample.

*[insert **Table 4** here]*

Heterogeneity analyses

Baseline mental health issues significantly moderated the intervention effect. Intervention was more effective for students with higher baseline mental health issues in reducing mental health issues, and enhancing positive self-management during classroom tasks ($d_{interaction}$ = -0.71; $p_{interaction}$ < .05, and $d_{interaction}$ = 0.63; $p_{interaction}$ < .05, respectively). After adjusting for multiple comparisons, within-family analyses showed that intervention had greater effects on SDQ

conduct problems ($d_{interaction}$ = -0.77; $p_{interaction}$ < .01). No other significant differences were found concerning the interaction between treatment conditions and baseline mental health.

The intervention was also more effective in reducing children's self-management issues for children who had a teacher with lower level of teaching experience (max 5 years) than for children who had a teacher with higher teaching experience ($d_{interaction}$ = -0.71, $p_{interaction}$ < .01; Suppl. 9). After adjusting for multiple comparisons, within-family analyses showed that intervention had greater effects on STRS conflict ($d_{interaction}$ = -0.74 $p_{interaction}$ < .05) and inCLASS negative engagement ($d_{interaction}$ = -0.60; $p_{interaction}$ < .05) in children who had a teacher with lower teaching experience. Moreover, intervention had a greater positive effect on positive relationships with peers in children who had a teacher with a lower teaching experience ($d_{interaction}$ = 0.53; $p_{interaction}$ < .05). No other significant differences were found concerning the interaction between treatment conditions and teaching experience.

Older students experienced a significant reduction in self-management issues after the intervention ($d_{interaction}$ = 0.04; $p_{interaction}$ < .05). After adjusting for multiple comparisons, within-family analyses showed a significant reduction in inCLASS negative engagement ($d_{interaction}$ = 0.05; $p_{interaction}$ < .05). No other significant differences were found concerning the interaction between treatment conditions and children's age.

We found no significant interaction between intervention conditions and gender and between intervention conditions and level of conduct problems at baseline (Suppl. 9).

Discussion

The present study is, to our knowledge, the first to assess the effects of a mindfulness-based social and emotional curriculum on preschool-aged children in the French school context, and the largest RCT to date evaluating a MBI in preschoolers. Teachers were highly satisfied with

the curriculum and motivated to implement the program in their classes. The number of delivered sessions and duration were consistent with our recommendations, and stood in the same range as previous studies evaluating MBIs in preschool children (Bockmann & Yu, 2022). Implementation fidelity assessed using audio-recordings of activities was very satisfactory.

Effects of the intervention on mental health

In accordance with our hypotheses, the program had a positive impact on children's mental health compared to teaching-as-usual. Teachers reported improvements in emotional, conduct and peer relationship problems, with effect sizes in the 0.20-0.30 range. Similar results were found in previous studies assessing the effects of MBIs in preschool children, in which MBIs reduced externalizing and internalizing behaviors, and enhanced emotion regulation (Bockmann & Yu, 2022; Crooks et al., 2020). Of note however, one previous study also found a positive effect of a MBI on SDQ hyperactivity score, which was not found in the present trial (Janz et al., 2019). Overall, our findings of positive effects on different dimensions of mental health are consistent with the Healthy Outcomes from Positive Experiences (HOPE) framework. In this framework, establishing positive relationships with adults and other children and developing self-awareness and self-management through peer interactions are considered key positive childhood experiences that promote children's mental health (Burstein et al., 2021).

Moderation analyses revealed some heterogeneity in the impact of the intervention on mental health between subgroups. Children with higher mental health issues at baseline showed greater improvement in mental health than children who had lower mental health issues at baseline. Increased effects of interventions on children with high mental health issues are consistent with

a recent interventional study which showed that initial emotional and behavioral problems were the best predictors of improvement in social and emotional competencies following a SEL intervention (Carroll et al., 2020).

Effects of the intervention on positive self-management during classroom tasks and self-management issues

Despite its positive effects on mental health, we did not detect a significant impact of the intervention on family estimates of positive or self-management issues in the whole sample. Still, intervention decreased conflictuality in the teacher-child relationship as measured through teacher questionnaires. This is in line with recent reviews (Blewitt et al., 2020; Cipriano et al., 2023) that suggest that SEL programs designed toward children also contribute to enhancing responsive and nurturing teacher-child interactions (Blewitt et al., 2020).

Children with higher mental health issues at baseline displayed greater improvement in positive self-management during classroom tasks. This is in line with other studies suggesting that MBIs have greater effects on self-management for preschool children with initial deficits in this indicator (Flook et al., 2015; Viglas & Perlman, 2018). Children who had a teacher with low teaching experience also showed greater reduction in self-management issues following intervention when compared to children who had a teacher with higher teaching experience. It is possible that teachers in their first years of activity face more challenges in implementing strategies to help children manage themselves, and that the intervention helps provide some of these strategies. It is also possible that teachers with low experience tend to implement SEL programs with higher adherence to the objective, which could contribute to better results on children's outcomes, including self-management. Finally, older children had greater reduction in self-management issues. Results for older children are somewhat consistent with the

literature. One meta-analysis suggested that general SEL programs were more effective for older children (Blewitt et al. 2018), while another meta-analysis directed at interventions that target specifically behavioral problems in children suggest that effect sizes are wider for younger children compared to older children (Wilson & Lipsey, 2007). In the first study of Flook et al. (2015), children were on average 5 months older than ours. It is possible that in our study, program contents designed to reduce management issues specifically are more adapted to older children.

Effects of the intervention on positive relationships with teachers and peers

We did not find a significant effect of the intervention on positive relationships with teachers and peers when considering the whole sample. These results stand in contrast with previous research, as previous SEL programs reported coherent positive effects of SEL programs on these outcomes (Cipriano et al., 2023; Durlak et al., 2011). In addition, these specific outcomes were directly targeted by the Kindness Curriculum activities implemented in the program, and a previous study assessing the efficacy of the Kindness Curriculum showed positive effects on prosocial behaviors (Flook et al 2015). Compared to the study of Flook et al. (2015), discrepancies could be explained by the fact that the measure of prosocial behavior used in this study was different from the one used in our study, or that this previous study was carried out on a much smaller sample of 68 children. Another possible explanation is that our population differs from the study of Flook et al (2015) in terms of socio-economic status: it is possible that the intervention, although sufficient to decrease behavioral problems, was insufficient to enhance prosocial behaviors in a socio-economically disadvantaged population.

Heterogeneity analyses revealed a positive effect of the intervention on positive relationships with peers for children in classes with teachers having low teaching experience. As discussed

above, teachers with lower teaching experience may follow the guidelines of the intervention more closely, leading to more prominent effects, or may have learnt strategies to help their pupils gain self-management skills, which contributed in turn to better relationships between pupils.

Effects of the intervention on emotional processing and executive functioning

We did not detect effects on task-based measures of emotional processing both in the whole sample and in all subgroups, and on task-based measures of executive functioning that were solely evaluated in the whole sample. Concerning executive functioning, previous MBIs and mindfulness-based SEL programs reported improvement in executive functioning in young children using experimental tasks (Crooks et al., 2020; Flook et al., 2015; Janz et al., 2019). However, these effects were detected on smaller samples and tasks that were not the same as the tasks completed in this study. The absence of an effect on emotional processing is unexpected, as the program directly targets competencies that relate to this indicator. Of note, executive functioning and emotional processing outcomes were assessed using experimental tasks only, and methodological issues described in the methodological considerations section below could explain the absence of positive results for these outcomes.

Interaction between intervention condition and children gender and baseline conduct problems

Contrary to our expectations, no significant moderation effect was found for children's gender and baseline conduct problems. Concerning gender differences, previous findings are mixed. For example, while one study suggested that boys could benefit more from a SEL intervention (Low et al., 2019), one study highlighted that although girls outperformed boys on social and

emotional competencies both before and after SEL intervention, boys did not demonstrate more or less social and emotional competencies growth than girls following intervention (Mondi & Reynolds, 2021). Finally, the absence of a differential impact between low and high baseline conduct problems suggests that conduct problem issues at baseline alone are less informative than global mental health issues that include conduct, emotional, attention/hyperactivity and relationship problems when predicting intervention's effects.

Effects of the intervention on teachers' well-being

We failed to detect an effect of the intervention on teachers' well-being. It should be noted that these analyses were conducted in the context of a lack of statistical power, as Table 3 shows an ex-post minimum detectable effect size ranging between 0.67 and 0.86. Children's emotional and behavioral problems and teacher stress and negative affect are mutually associated (Narea et al., 2022). Therefore, we could expect that SEL programs directed toward children's social and emotional competencies would lead to increased teacher well-being. While positive teacher-child relationships have positive impacts on teacher occupational well-being (Nwoko et al., 2023), only a few studies have explored the impact of a SEL program designed for children on teacher well-being. One recent study assessing the impact of the mindfulness-based SEL program OpenMind for preschool children showed no effects on teachers' mindfulness-trait and perceived stress, even if this program included a short mindfulness course for teachers (Jackman et al., 2019).

Strengths of the study

This study displayed several strengths, as it used a RCT design with a pre-published analytic plan and a larger sample size than previous studies of MBIs in preschool-aged children. It

included multi-informant reports, with teacher-rated questionnaires, standardized observations by observers masked to study allocation and objectives, and behavioral tasks. Implementation fidelity was assessed through audio-recordings that were all double-coded by evaluators, and teacher implementation showed great fidelity over the school year.

Methodological considerations and limitations

In the present study, effects of intervention in the whole sample were detected using teacher-report questionnaires or family-based standardized estimates integrating teacher-report questionnaires. No significant effects were found using masked observation or experimental task measures alone. Different interpretations of this discrepancy can be proposed. First, one may consider that questionnaire measures are biased, whereas masked observations and experimental task measures are not, as teachers in the intervention group may overestimate children's progress following intervention (Boon-Falleur et al., 2022). It is also possible that use of the curriculum led to decreased stress levels for teachers who became more tolerant toward children's problem behaviors (Bockmann & Yu, 2022). In this view, questionnaire-based significant changes may not reflect true changes. On the contrary, one may consider that teacher-reported questionnaires evaluate central tendencies in the behavior of children that are not easily captured by observational tools and tasks, which measure behavior at the time of the experiment or observation, and not the average level of performance over a longer period of time (Boon-Falleur et al., 2022). Recent evidence indeed suggests that behavioral tasks fare poorly compared to questionnaires to measure individual differences in behavior (Palminteri & Chevallier, 2018). In the field of social and emotional competencies, one study found that teacher-rated questionnaires were more accurate predictors of self-management and academic outcomes compared to behavioral tasks (Boon-Falleur et al., 2022).

Of note, in the present study, correlations between task-based and questionnaire measures on the one hand, and observational and questionnaire measures on the other were all in the weak range, even when related constructs (for example, self-management issues) were evaluated. In particular, despite evaluating children's behavior in the same context, inCLASS variables and teacher-rated measures were all weakly correlated. Here, inCLASS measures were all collected on the same day. Future studies should investigate whether adding more time points for data collection for inCLASS measures results in stronger correlations with teacher-rated measures of similar constructs.

Finally, methodological limitations of the present study may also explain the discrepancy between questionnaire-based and other measures findings. First, in our study design, children that displayed severe behavioral issues, children with suspected neurodevelopmental disorders and children with comprehension/expression difficulties in French were excluded from the masked observations and experimental tasks protocol. This may have prevented us from capturing changes occurring in these subgroups of children with these measures. Second, whereas our a priori power calculation for the whole sample was based on an expected minimum detectable effect size of 0.35, all effects detected in this study were below this threshold, indicating that our initial sample should have been increased. Third, and in line with the previous point, several of our task-based and observational measures suffered from attrition, which was particularly severe for the last tasks of our experimental protocol, possibly due to children's tiredness. This resulted in limited post-hoc power for these measures, which may have prevented us from detecting intervention effects. Ex-post minimum detectable effect size for inCLASS measures ranged between 0.37 and 0.50 SD in the whole sample (Table 3), and between 0.01 and 0.60 for heterogeneity analyses. Hence, it may be the case that the intervention has some smaller but meaningful effects on observational outcomes that we are not able to detect with this sample size. Fourth, some of our observational and experimental

task measures also suffered from differential attrition, which could have contaminated our findings in an unmeasurable way.

The fact that this study did not include parent-report questionnaires should be mentioned as a last limitation. Without such measures, we do not know if the decrease in mental health issues found at school after the intervention would also have been detectable in the home setting, nor if the intervention had a positive effect on parent-child relationships.

Future directions

Considering the promising results found in this study, this mindfulness-based SEL curriculum deserves further investigations to strengthen its evidence-base.

First, here, treatment-effects were only assessed over a school year. Follow-up data is currently being collected to assess the effects of the intervention 6 months after the end of the curriculum using teacher-rated measures. Potential effects of the intervention on academic outcomes will also be assessed for children during the first year of elementary school, using French national evaluations. Future studies should evaluate this curriculum over a longer period in a larger sample, including parent-rated measures of mental health and self-rated measures of psychological well-being in older children, to provide a more complete picture of intervention impact.

Second, in the last decade, a new wave of studies has highlighted the importance of systemic SEL, which involves the whole school and parents in SEL interventions to establish consistent practices across school grades and environments (classroom, whole school, and home) (Liew & Spinrad, 2022; Mahoney et al., 2021). Although the precise added-value of parental involvement in SEL programs is still not clear (Durlak et al., 2011), lack of parental involvement could prevent the generalization of learned strategies outside the school

environment. However, to date, only a few studies using mindfulness-based SEL programs have included parental components (Bockmann & Yu, 2022). In the future, sharing digital content related to curriculum activities with parents could be an interesting add-on, as well as training all the other school professionals on related social and emotional competencies.

Third, in this study, program training was delivered by a research team in a typical RCT efficacy measurement approach. Future studies should investigate the optimal processes to disseminate this intervention in France, involving key stakeholders (Soneson et al., 2022), and evaluate the efficiency and sustainability of the intervention when delivered by local trainers after dissemination (Porzsolt et al., 2015).

Fourth, the intervention was implemented in a socio-economically disadvantaged area. It would be interesting to explore if its effects are similar in French areas with higher socio-economic status: A previous meta-analysis found that behavioral problems prevention programs' effect sizes were larger for children with low socio-economic status (Wilson & Lipsey, 2007). When considering SEL programs more specifically, reports of differential effects of programs on children from diverse socio-economical family status are inconsistent (Garner et al., 2014; Mondi & Reynolds, 2021). Future studies should also investigate whether program delivery to all children is relevant or whether it should be restricted to schools located in disadvantaged areas.

Finally, although total time dedicated to the curriculum was consistent with our recommendations, there were individual preferences in the implementation of the different activities between teachers, with some teachers implementing more of one type of activity and somewhat neglecting another activity over the course of the year. The given reasons were often teachers' lack of interest in implementing one activity, or a lack of interest and comprehension difficulties from their students for this activity. These challenges were mostly evoked for the emotion circle time activity. It is possible that this activity, targeting mostly interpersonal skills,

was more difficult to implement at the beginning of the year, as previous meta-analysis showed that the most efficient SEL programs are the ones that develop intrapersonal skills before interpersonal skills (Cipriano et al., 2023). However, we lacked the statistical power to calculate if there were disparities in efficacy between each type of activity, i.e., if some activities were more effective than others in improving children's outcomes, or to try to identify the most active components of the program, which could be an interesting topic for a future study (Bockmann & Yu, 2022).

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