Promoting psychological well-being in preschoolers through mindfulness-based socioemotional learning: A randomized-controlled trial

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Introduction

Rates of emotional problems in children and young people (CYPs) 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 CYPs 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). Mental disorders are the leading cause of disability in CYPs, accounting for a quarter of all years lived in disability in this population (Erskine et al., 2015). Long-term negative effects 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 CPYs 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).

Promoting CYPs' psychological well-being

According to the PERMA framework, psychological well-being (P-WB) depends on five core subjective components: positive emotions, engagement, positive relationships, meaning, and accomplishment (Kern et al., 2015). CYPs spend most of their waking time at school on weekdays,

making the school setting both a crucial and preferential context for universal primary mental health prevention (Weist et al., 2023). Prevention science suggests that school environments nurture P-WB 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 P-WB (Bailey & Jones, 2019; 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).

Among the various approaches available to promote P-WB, mindfulness-based interventions (MBIs) have demonstrated the greatest efficacy in both clinical and non-clinical populations in adults (van Agteren et al., 2021). MBIs are systematic mental training protocols that target three key self-related processes: Meta-awareness of self (self-awareness), the ability to effectively manage or alter one's responses and impulses (self-regulation), and the development of a positive relationship between self and others that transcends self-focused needs and increases prosocial characteristics (self-transcendence) (Vago & Silbersweig, 2012). Mindfulness exercises typically cultivate present-moment awareness with metacognitive insight, facilitating sensory contact with the environment and reducing rumination and other automatic thought patterns (Brown et al., 2007). Mindfulness practice also encourages impulse control and self-

regulation in challenging social situations, perspective taking and awareness of others' experiences and needs (Brown et al., 2007).

The effects of MBIs interventions in preschool-aged children

In CYPs, 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 blind 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 (KC)

In preschool settings, one of the available MBIs with the strongest evidence-base is the *Kindness Curriculum* (KC), a sequence of lessons designed to increase self-awareness, self-regulation, 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 KC was evaluated in two previous cluster randomized controlled trials (RCTs) 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 from 7 classrooms (Flook et al., 2015), and for attention control and self-regulation 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 KC'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 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 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).

The current study

In sum, there is currently a need to improve the evidence-base for early P-WB promotion interventions in preschoolers through replication studies with minimal risk of methodological bias, and the KC 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, the Programme for International Student Assessment (PISA)'s studies have repeatedly found delays in socio-emotional competencies (SEC) such as self-regulation in French students (Algan et al. 2018). Since 2016, supporting Social and Emotional Learning (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. The main component of the program was an adapted version of the KC tailored to be delivered weekly during the school year. The adapted KC was reinforced by two other weekly delivered ritualized components: body-oriented exercises' sessions targeting core mindfulness self-related processes in line with KC content (Tolbaños-Roche & Menon, 2021), and an emotion circle time fostering collective emotional awareness and prosocial behaviors [Author(s)]. Given the strong association between socio-economic status and self-regulation (Ng-Knight & Schoon, 2017) as well as P-WB (Poulain et al., 2019), this intervention was implemented and

evaluated in a predominantly socio-economically disadvantaged French department. 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 blinded standardized observations and experimental tasks. Analyses were pre-registered [Author(s)]. We hypothesized that the intervention would lead to more favorable outcomes on collected measures after 24 weeks of program exposure. We also investigated heterogeneous effects by conducting subgroup analyses based on child-level and teacher-level indicators [Author(s)].

Methods

Participants' recruitment

The study protocol has been described in detail previously (see [Author(s)]). 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 [Author 5] 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 in-class observations and 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).

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 [Authors 1 and 5] of parent refusal. Oral consent was also obtained from children before experimental task data collection.

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 (SD) (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 P-WB promotion 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 [Author 1].

Allocation sequence was generated by one of the principal investigators [Author 5]. Children's assessments were carried out by certified evaluators who were blinded to study objectives and group allocation. Blinding 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. An investigator blinded to group allocation [Author 1] was in charge of data collection.

Procedure for data collection

Before intervention (T0; Oct. 2021), electronic forms with questionnaires assessing children's baseline outcome variables were completed by teachers. Blinded 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 Author 1 and a research assistant. They were also certified for the inCLASS tool, following the certification procedure of the inCLASS developers (Downer et al., 2010).

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.

Before endline assessment, blinded 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). After

intervention (endline, 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. Questions related to teachers' characteristics (demographics, well-being level) were also completed by all teachers at T1.

Implementation fidelity was reported using two different procedures. First, teachers in the intervention group wrote in a standardized notebook the curriculum 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 (KC, yoga, and emotion circle) were recorded and transferred to a principal investigator [Author 1]. Records were then all 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 double-coded using a 4-point Likert scale from 0 to 3 (with 0 = "not respected at all" and 3 = "totally respected"). Inter-rater agreement (1-point difference maximum between the two evaluators) was high: 95.7%, 96.4% and 94.2% of double-coding reached agreement relating to compliance with the objectives, compliance with the structure and content, and appropriate teacher posture, respectively.

Conditions

Intervention

Teachers in the intervention group were trained for 2 days (Nov. 2021). Training was provided by 1) a principal investigator [Author 5] specialized in cognitive behavioral therapy, including mindfulness; 2) [Author 3], 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 P-WB promotion intervention is composed of a set of three activities: 1) a progressive mindfulness-based SEL curriculum (i.e., the French adaptation of the KC), 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).

Wait-list control group

Teachers allocated to the control group carried on their normal academic activities. They were told that they could access the program training and materials one year after evaluation (Sept. 2022). P-WB or SEC are not directly targeted by French academic programs for preschool. However, some teachers in the control group may decide to independently implement other activities tarteging P-WB or SEC. To control for this possibility, teachers were asked at the end of the year to report any activity implemented in their class that targeted SEC or P-WB. 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 our 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 our program (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 our program, other activities that shared one or two components with it. These teachers were not excluded and remained in their respective group.

Measures

We used the following teacher-report questionnaires to assess children's behaviors and teacher-child relationship: The Preschool and kindergarten behavior scale (PKBS)- Social skills, the Student-teacher relationship scale-short form (STRS), and the Strengths and difficulties questionnaire (SDQ)-extended teacher version. Demographic questions (age, gender) were also collected. Self-rated measures were also used to measure teachers' well-being: the Comprehensive inventory of mindfulness experience (CHIME), the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS), the Satisfaction with professional life scale (« Échelle de Satisfaction de Vie Professionnelle »; ESVP), and a commitment scale. Questionnaires assessing children's behaviors were completed by

standardized observations of children using the inCLASS observation tool, and by a set of experimental task measures: the Challenging Situations task (CST), the Emotion matching task-expressive knowledge, the Peer acceptance task, and an executive functioning battery (EF Touch). Both standardized observations and tasks were run by blinded evaluators. Detailed description of each measure is available in Suppl 2.

Data analyses

Data were analyzed using Stata (version 17) and Jamovi (version 2.2). 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). Heterogeneous effects were also estimated for sex (boys), level of experience of the teachers (teachers with less than five years of experience), children's age (children above median age), negative mental health (elevated baseline global negative mental health scores; family 1) and conduct problems (above SDQ median conduct problem score).

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). In particular, around 91% of teachers answered the endline questionnaires in the intervention

group and 88% in the control group. 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). Considering the high level of differential attrition found for executive functioning measures and the fact that the imputation procedure for the planned missing data was time-consuming, we chose to remove executive functioning variables from the estimations for heterogeneous effect sizes.

Descriptive statistics and correlation analyses

Teachers and children characteristics are presented in Table 2.

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

Mean teacher age was 37.1 years-old (SD = 6.1). Most teachers were female (96.5%), had between 6 and 20 years of teaching experience (61.4%), and worked in an education priority area (75.0%). At baseline, children were on average 51.8 months-old (SD = 3.5). 52.7% of children were girls. 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 = .403, p = .007; r = .602, p < .001 respectively). Mean commitment score (including satisfaction and motivation) was high (M = 4.56; SD = .41). Concerning the time dedicated to each activity, the 29 teachers for whom data were available dedicated on average 28.7 hours (SD = 10.2) to program implementation (Suppl 7). Heterogeneity was relatively high, with a minimum of 9.6 hours to a maximum of 49.0 hours in total. Teachers spent more hours implementing KC curriculum (M = 12.5 hours; SD = 4.4) and yoga-based activities (M = 9.7; SD = 4.8) compared to emotion circle time (M = 6.5 hours; SD = 3.9). Concerning implementation fidelity, 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 = 2.7, SD = .5; M = 2.5, SD = .7; M = 2.7, SD = .5, 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 failed to 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 negative mental health (d = 0.265 ; p < .001) as a whole, and within-family effects were found for SDQ emotional problems (d = 0.243 ; p = .005), SDQ conduct problems (d = 0.145 ; p = .019), SDQ peer relationship problems (d = 0.228 ; p = .006) and STRS conflict (d = 0.178 ; 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

Intervention effects on boys: Positive effects were found on negative mental health in boys (d = 0.334; p < .001; Suppl 9). Effect of the intervention on negative mental health was 26% larger in this subgroup compared to the whole sample. Within-family analyses showed significant effects for SDQ emotional problem (d = 0.314; p = .007), and SDQ conduct problem (d = 0.235; p = .023), with decreased mean scores in the intervention group while scores in the control group remained stable, and for SDQ peer relationships (d = 0.208; p = .022), with a larger decrease in mean scores in the intervention group compared to the control group. Effects were 29% larger than the whole sample for emotional problems, and 62% larger than in the whole sample for conduct problems. Intervention effects were also found for positive self-management (d = 0.198; p = .049). Scores in the intervention group also significantly decreased for STRS conflict compared to the control group, where scores remained stable (d = 0.296; p = .002). Effect of the intervention on STRS conflict was 66% larger in this subgroup compared to the whole sample. No positive effects were found on the other outcomes for boys.

Intervention effects on children with teachers having low levels of teaching experience: In the subgroup of children with teachers with low levels of teaching experience (max 5 years), intervention decreased mental health

difficulties (d = 0.367, p = .001; Suppl 10). Within-family analyses showed significant moderate effects for SDQ emotional problem (d = 0.353; p = .012), SDQ conduct problem (d = 0.313; p = .004), and for SDQ peer relationships (d = 0.368; p = .011), with decreased mean scores in the intervention group while scores in the control group remained stable. Scores in the control group also moderately increased for STRS conflict compared to the intervention group, whose scores remained stable (d = 0.349; p = .024). Intervention also led to a weak but significant increase in positive self-management (d = 0.267; p = .036), which was mostly driven by PKBS autonomy score (d = 0.284; p = .002). Autonomy scores increased in the intervention group while remaining stable in the control group. Significant positive effects were also found for this subgroup on STRS closeness (d = 0.361; p = .039), where STRS closeness score increased more in the intervention group compared to the control group. Finally, children with teachers having a low level of teaching experience displayed more global positive relationships with their peers compared to children in the control group (d = 0.186; p = .017).

Intervention effects on older children: In the subgroup of older children, intervention decreased mental health difficulties (d = 0.339, p < .001). Effect of the intervention on negative mental health in this subgroup was 28% larger compared to the whole sample, and 52% larger for SDQ emotional problems (d = 0.369, p < .001; Suppl 11). Intervention also impacted SDQ peer relationship problems (d = 0.325, p = .002) with a 42% larger impact than in the whole sample. Intervention had no impact on the

family of positive relationships with peers; however, a significant difference between conditions emerged for PKBS agreeableness (d = .235, p = .047). No significant effects were found on the other outcomes.

Intervention effects on children with low baseline mental health: In the intervention group, children with lower mental health at baseline displayed a decrease in negative mental health compared to the control group (d = 0.375, p < .001; Suppl 12). This effect was 41% larger than in the whole sample. SDQ emotional problem score decreased 48% more compared to the whole sample (d = 0.359, p = .001), SDQ conduct problem score decreased 85% more (d = 0.268, p = .007), and SDQ peer relationship problems decreased 42% more (d = 0.323, p = .002). A 63% larger decrease was observed for SDQ impact score compared to the whole sample (d = 0.214, p = .048). Positive effects of intervention on negative self-management were also found (d = 0.211, p = .031). This effect was mostly driven by STRS conflict scores (d = 0.306, p = .006). Effect of the intervention on STRS conflict was 72% larger in this subgroup compared to the whole sample. In this subgroup, intervention also had a significant positive impact on positive relationships with teachers (d = 0.266, p = .040). No significant effects were found on the other outcomes.

Intervention effects on children with high conduct problems at baseline: For children with higher conduct problems at baseline, we found a positive impact of intervention on negative mental health (d = 0.384, p < .001; Suppl 13). Effect on mental health for this subgroup was 44% larger than

in the whole sample. We found significant effects in the intervention group compared to the control group for SDQ emotional problem score (d = 0.308, p < .001), SDQ peer relationship problem score (d = 0.223, p = .015), and SDQ conduct problem score (d = 0.263, p = .046). Effects were, respectively, 26% larger for SDQ emotional problems and 81% larger for SDQ conduct problems than in the whole sample. No significant effects were found on the other outcomes.

Discussion

The present study is, to our knowledge, the first to assess the effects of a mindfulness-based socio-emotional curriculum on preschool-aged children in the French school context, and the largest RCT to date evaluating a mindfulness-based intervention 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 (including SEL components or not) in preschool children (Bockmann & Yu, 2022). Implementation fidelity assessed using audio-recordings of activities was judged very satisfactory.

Effects of the intervention on mental health

In accordance with our hypotheses, this curriculum 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 0.2-0.3 range. Similar results were found

in a recent literature review assessing the effects of MBIs in preschool children, in which MBIs reduced behavioral problems and enhanced emotion regulation (Bockmann & Yu, 2022). More specifically, some studies suggest that MBIs lead to decreased externalizing and internalizing behaviors such as anxiety and aggression (Crooks et al., 2020). Of note however, one previous study also found a positive effect of a MBIs 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. HOPE focuses on positive experiences that prevent mental health issues in children. In this framework, establishing positive relationships with adults and other children and developing self-awareness and self-regulation through peer interactions are considered key positive childhood experiences that promote children's mental health (Burstein et al., 2021).

Subgroup analysis revealed some heterogeneity in the impact of intervention on mental health between subgroups. Boys, older children, children with higher conduct problems at baseline, and children with higher negative mental health at baseline showed greater improvement in mental health than the sample as a whole. Increased effects on children with low mental health are consistent with previous studies highlighting that MBIs have greater effects on diverse indicators, e.g., self-regulation, prosocial behaviors or hyperactivity for preschool children with initial deficits in these indicators (Flook et al., 2015; Viglas & Perlman, 2018). Results for older children are not consistent with the literature. In a

previous study, the effect sizes of interventions that target behavioral problems in children were larger for younger children compared to older children (Wilson & Lipsey, 2007). It is possible that in our study, program content was more adapted to older children. In the first evaluation study of the KC, children were on average 5 months older than our sample.

Effects of the intervention on positive and negative self-management

Despite its positive effects on mental health, we failed to detect a significant impact of our intervention on family estimates of positive or negative self-management 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, with reduced teacher-child conflicts (Blewitt et al., 2020).

Children with low mental health at baseline specifically displayed improvement in negative self-management. In addition, boys showed specific improvements in positive self-management, as assessed both through teacher questionnaires and observations by independent evaluators. This stands in contrast with a previous SEL study that highlighted that although girls outperformed boys on SEC both before and after SEL intervention, boys did not demonstrate more or less SEC growth than girls during intervention (Mondi & Reynolds, 2021). Finally,

intervention prevented teacher-child conflict from increasing, and enhanced positive self-management compared to control for children in classes with teachers with low 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 our 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.

Effects of the intervention on positive relationships with teachers and peers

We did not find a significant effect of our 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 KC activities implemented in our program, and a previous study assessing the efficacy of the KC 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 our 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 our intervention on teacher-child closeness and positive relationships with peers for children in classes with teachers having low experience. Positive relationships with teachers, including teacher-child closeness, were also positively impacted by intervention for children with low mental health at baseline. Finally, intervention had a positive impact on agreeableness with peers for older children.

Effects of the intervention on emotional processing and executive functioning

We failed to 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 evaluated in the whole sample only. 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 our 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.

Effects of the intervention on teachers' well-being

We failed to detect an effect of our 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 SEC would lead to increased teacher well-being. While positive teacher-child relationships (that can be promoted through SEL programs) 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).

Methodological considerations

In the present study, effects of intervention were detected using teacher-report questionnaires or family-based standardized estimates integrating teacher-report questionnaires. No significant effects were found using

blinded-observation or experimental task measures alone. Different interpretations of this discrepancy can be proposed.

First, one may consider that questionnaire measures are biased, whereas blinded-observations and experimental task measures are not, as teachers in the intervention group may be prone to “reference bias” where they 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 (which were not directly measured in our study) 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 standard questionnaires to measure individual differences in behavior (Palminteri & Chevallier, 2018). In the field of SEC, one study found that teacher-rated questionnaires were more accurate predictors of self-regulation 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, negative self-management) 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 issues may also explain the discrepancy between questionnaire-based and other measures findings. First, in our study design, children that displayed severe behavioral issues were excluded from the blinded observations and experimental tasks protocol. This may have prevented us from capturing the changes occurring in this subgroup of children with these measures. Second, whereas our a priori power calculation was based on an expected MDES of 0.35, all effects detected in this study were below this threshold, indicating that our initial sample should have been increased. Table 3 shows an ex-post minimum detectable effect size for InCLASS measures ranging between 0.37 and 0.50 SD. 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. 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. As an example, in the whole sample, considering the standard

errors found for inCLASS positive engagement with tasks, our study was only powered to detect a group difference superior to .45, without correction for multiple testing. Fourth, some of our observational and experimental task measures also suffered from differential attrition, which could have contaminated our findings in an unmeasurable way.

Strengths and limitations

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 mindfulness-based interventions in preschool-aged children. It included multi-informant reports, with teacher-rated questionnaires, standardized observations by observers blinded 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. Limitations mostly concerned statistical power for task-based and observational measures, with issues of attrition and differential attrition.

Future directions

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

First, here, treatment-effects were only assessed over a school year, and mental health was evaluated through teacher-rated questionnaires only. 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 our 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, 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 SECs.

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, our intervention was implemented in a socio-economically disadvantaged area. As higher socio-economic status is associated with fewer behavioral difficulties (Poulain et al., 2019), 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 our program, which could be an interesting topic for a future study (Bockmann & Yu, 2022).

References

Abadie, A., Athey, S., Imbens, G. W., & Wooldridge, J. (2017). When should you adjust standard errors for clustering? *National Bureau of Economic Research, Inc.*, *NBER Working Papers 24003*.

Algan, Y., Huillery, É., & Prost, C. (2018). *Confiance, coopération et autonomie : Pour une école du xxie siècle* (Notes du conseil d'analyse économique 48 ; p. 12). Conseil d'analyse économique. http://www.cairn.info/revue-notes-du-conseil-d-analyse-economique-2018-3-page-1.htm

American Academy of Pediatrics, American Academy of Child and Adolescent Psychiatry, & Children's Hospital Association. (2021). *AAP-AACAP-CHA Declaration of a National Emergency in Child and Adolescent Mental Health*. American Academy of Pediatrics. https://www.aap.org/en/advocacy/child-and-adolescent-healthy-mental-development/aap-aacap-cha-declaration-of-a-national-emergency-in-child-and-adolescent-mental-health/

Anderson, M. L. (2008). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. *Journal of the American Statistical Association*, *103*(484), 1481-1495. https://doi.org/10.1198/016214508000000841

Bailey, R., & Jones, S. M. (2019). An integrated model of regulation for applied settings. *Clinical Child and Family Psychology Review*, *22*(1), 2-23. https://doi.org/10.1007/s10567-019-00288-y

Belloni, A., Chernozhukov, V., & Hansen, C. (2014). Inference on treatment effects after selecting among high-dimensional controls. *The Review of Economic Studies*, *81*(2), 608-650. https://doi.org/10.1093/restud/rdt044

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), 289-300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Biglan, A., Flay, B. R., Embry, D. D., & Sandier, I. N. (2012). The critical role of nurturing environments for promoting human well-being. *American Psychologist*, *67*(4), 257-271. https://doi.org/10.1037/a0026796

Blair, C. B., & Raver, C. C. (2015). School Readiness and Self-Regulation: A Developmental Psychobiological Approach. *Annu Rev Psychol.*, *66*, 711-731.

Blewitt, C., O'Connor, A., Morris, H., Mousa, A., Bergmeier, H., Nolan, A., Jackson, K., Barrett, H., & Skouteris, H. (2020). Do curriculum-based Social and Emotional Learning programs in early childhood education and care strengthen teacher Outcomes? A systematic literature review. *International Journal of Environmental Research and Public Health*, *17*(3), 1049. https://doi.org/10.3390/ijerph17031049

Bloom, H. S. (2006). The core analytics of randomized experiments for social research. In P. Alasuutari, L. Bickman, & J. Brannen, *The SAGE Handbook of Social Research Methods* (p. 115-133). SAGE Publications Ltd. https://doi.org/10.4135/9781446212165.n9

Bockmann, J. O., & Yu, S. Y. (2022). Using mindfulness-based interventions to support self-regulation in young children: A review of the literature. *Early Childhood Education Journal*, *21*, 1-11.

Boon-Falleur, M., Bouguen, A., Charpentier, A., Algan, Y., Huillery, É., & Chevallier, C. (2022). Simple questionnaires outperform behavioral tasks to measure socio-emotional skills in students. *Scientific Reports*, *12*(442). https://doi.org/10.1038/s41598-021-04046-5

Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, *18*(4), 211-237. https://doi.org/10.1080/10478400701598298

Burstein, D., Yang, C., Johnson, K., Linkenbach, J., & Sege, R. (2021). Transforming practice with HOPE (Healthy Outcomes from Positive Experiences). *Maternal and Child Health Journal*, *25*(7), 1019-1024. https://doi.org/10.1007/s10995-021-03173-9

Cipriano, C., Strambler, M. J., Naples, L. H., Ha, C., Kirk, M., Wood, M., Sehgal, K., Zieher, A. K., Eveleigh, A., McCarthy, M., Funaro, M., Ponnock, A., Chow, J. C., & Durlak, J. (2023). The state of evidence for social and emotional learning: A contemporary meta-analysisof universal school-based SEL interventions. *Child Development*, *Epub ahead of print*, cdev.13968. https://doi.org/10.1111/cdev.13968

Collishaw, S. (2015). Annual research review: Secular trends in child and adolescent mental health. *Journal of Child Psychology and Psychiatry*, *56*(3), 370-393. https://doi.org/10.1111/jcpp.12372

Copeland, W., Shanahan, L., Costello, E. J., & Angold, A. (2011). Cumulative prevalence of psychiatric disorders by young adulthood: A prospective cohort analysis from the Great Smoky Mountains study. *Journal of the American Academy of Child & Adolescent Psychiatry*, *50*(3), 252-261. https://doi.org/10.1016/j.jaac.2010.12.014

[Author(s); Manuscript submitted for publication]

[Author(s), 2022]

Crooks, C. V., Bax, K., Delaney, A., Kim, H., & Shokoohi, M. (2020). Impact of MindUP among young children: Improvements in behavioral problems, adaptive skills, and executive functioning. *Mindfulness*, *11*(10), 2433-2444. https://doi.org/10.1007/s12671-020-01460-0

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction With Life scale. *Journal of Personality Assessment*, *49*(1), 71-75. https://doi.org/10.1207/s15327752jpa4901_13

Doran, C. M., & Kinchin, I. (2017). A review of the economic impact of mental illness. *Australian Health Review*, *43*(1), 43-48. https://doi.org/10.1071/AH16115

Downer, J. T., Booren, L. M., Lima, O. K., Luckner, A. E., & Pianta, R. C. (2010). The Individualized Classroom Assessment Scoring System (inCLASS): Preliminary reliability and validity of a system for observing preschoolers' competence in classroom interactions. *Early Childhood Research Quarterly*, *25*(1), 1-16. https://doi.org/10.1016/j.ecresq.2009.08.004

Durlak, J. A., Weissberg, R. P., Dymnicki, A. B., Taylor, R. D., & Schellinger, K. B. (2011). The impact of enhancing students' social and emotional learning: A meta-analysis of school-based universal interventions. *Child Development*, *82*(1), 405-432. https://doi.org/10.1111/j.1467-8624.2010.01564.x

Erskine, H. E., Moffitt, T. E., Copeland, W. E., Costello, E. J., Ferrari, A. J., Patton, G., Degenhardt, L., Vos, T., Whiteford, H. A., & Scott, J. G. (2015). A heavy burden on young minds: The global burden of mental and substance use disorders in children and youth. *Psychological Medicine*, *45*(7), 1551-1563. https://doi.org/10.1017/S0033291714002888

Flook, L., Goldberg, S. B., Pinger, L., & Davidson, R. J. (2015). Promoting Prosocial Behavior and Self-Regulatory Skills in Preschool Children Through a Mindfulness-Based Kindness Curriculum. *Developmental Psychology*, *51*(1), 44-51.

Garner, P. W., Mahatmya, D., Brown, E. L., & Vesely, C. K. (2014). Promoting desirable outcomes among culturally and ethnically diverse children in Social Emotional Learning programs: A Multilevel heuristic model. *Educational Psychology Review*, *26*(1), 165-189. https://doi.org/10.1007/s10648-014-9253-7

Jackman, M. M., Nabors, L. A., McPherson, C. L., Quaid, J. D., & Singh, N. N. (2019). Feasibility, acceptability, and preliminary effectiveness of the OpenMind (OM) program for preschool children. *Journal of Child*

and Family Studies, *28*(10), 2910-2921. https://doi.org/10.1007/s10826-019-01506-5

Janz, P., Dawe, S., & Wyllie, M. (2019). Mindfulness-based program embedded within the existing curriculum improves executive functioning and behavior in young children: A waitlist controlled trial. *Frontiers in Psychology*, *10*(2052). https://doi.org/10.3389/fpsyg.2019.02052

Kern, M. L., Waters, L. E., Adler, A., & White, M. A. (2015). A multidimensional approach to measuring well-being in students: Application of the PERMA framework. *The Journal of Positive Psychology*, *10*(3), 262-271. https://doi.org/10.1080/17439760.2014.936962

Lamboy, B., Arwidson, P., du Roscoat, E., Fréry, N., Lecrique, J.-M., Shankland, R., Tessier, D., & Williamson, M.-O. (2022). *Les compétences psychosociales : Un référentiel pour un déploiement auprès des enfants et des jeunes. Synthèse de l'état des connaissances scientifiques et théoriques réalisé en 2021* (p. 37). Santé Publique France. https://www.santepubliquefrance.fr/docs/les-competences-psychosociales-un-referentiel-pour-un-deploiement-aupres-des-enfants-et-des-jeunes.-synthese-de-l-etat-des-connaissances-scientif

Liew, J., & Spinrad, T. L. (2022). Emotional self-regulation processes as foundation for social-emotional competencies and whole-child school success. In *Emotional self-regulation processes as foundation for social-emotional competencies and whole-child school success* (Taylor&Francis). Routledge. https://doi.org/10.4324/9781138609877-REE108-1

Mahoney, J. L., Weissberg, R. P., Greenberg, M. T., Dusenbury, L., Jagers, R. J., Niemi, K., Schlinger, M., Schlund, J., Shriver, T. P., VanAusdal, K., & Yoder, N. (2021). Systemic social and emotional learning: Promoting educational success for all preschool to high school students. *American Psychologist*, *76*(7), 1128-1142. https://doi.org/10.1037/amp0000701

Mondi, C. F., & Reynolds, A. J. (2021). Socio-Emotional Learning among low-income prekindergarteners : The roles of individual factors and early intervention. *Early Education and Development*, *32*(3), 360-384. https://doi.org/10.1080/10409289.2020.1778989

Murano, D., Sawyer, J. E., & Lipnevich, A. A. (2020). A meta-analytic review of preschool Social and Emotional Learning interventions. *Review of Educational Research*, *90*(2), 227-263. https://doi.org/10.3102/0034654320914743

Narea, M., Treviño, E., Caqueo-Urízar, A., Miranda, C., & Gutiérrez-Rioseco, J. (2022). Understanding the relationship between preschool teachers' well-being, interaction quality and students' well-being. *Child Indicators Research*, *15*(2), 533-551. https://doi.org/10.1007/s12187-021-09876-3

Nearchou, F., Flinn, C., Niland, R., Subramaniam, S. S., & Hennessy, E. (2020). Exploring the impact of COVID-19 on mental health outcomes in children and adolescents: A systematic review. *International Journal of Environmental Research and Public Health*, *17*(22), 8479. https://doi.org/10.3390/ijerph17228479

Ng-Knight, T., & Schoon, I. (2017). Disentangling the influence of socioeconomic risks on children's early self-control. *Journal of Personality*, *85*(6), 793-806. https://doi.org/10.1111/jopy.12288

Nwoko, J. C., Emeto, T. I., Malau-Aduli, A. E. O., & Malau-Aduli, B. S. (2023). A systematic review of the factors that influence teachers' occupational wellbeing. *International Journal of Environmental Research and Public Health*, *20*, 6070. https://doi.org/10.3390/ijerph20126070

Pagerols, M., Prat, R., Rivas, C., Español-Martín, G., Puigbó, J., Pagespetit, È., Haro, J. M., Ramos-Quiroga, J. A., Casas, M., & Bosch, R. (2022). The impact of psychopathology on academic performance in school-age children and adolescents. *Scientific Reports*, *12*(4291). https://doi.org/10.1038/s41598-022-08242-9

Palminteri, S., & Chevallier, C. (2018). Can we infer inter-individual differences in risk-taking from behavioral tasks? *Frontiers in Psychology*, *9*, 2307. https://doi.org/10.3389/fpsyg.2018.02307

Phan, M. L., Renshaw, T. L., Caramanico, J., Greeson, J. M., MacKenzie, E., Atkinson-Diaz, Z., Doppelt, N., Tai, H., Mandell, D. S., & Nuske, H. J. (2022). Mindfulness-based school interventions: A systematic review of outcome evidence quality by study design. *Mindfulness*, *13*(7), 1591-1613. https://doi.org/10.1007/s12671-022-01885-9

Poehlmann-Tynan, J., Vigna, A. B., Weymouth, L. A., Gerstein, E. D., Burnson, C., Zabransky, M., Lee, P., & Zahn-Waxler, C. (2016). A pilot study of contemplative practices with economically disadvantaged preschoolers : Children's empathic and self-regulatory behaviors. *Mindfulness*, *7*(1), 46-58. https://doi.org/10.1007/s12671-015-0426-3

Porzsolt, F., Galito, N., Toledo-Arruda, A., Thomaz, T., Moraes, C., Guerra, T., Leão, M., Migowski, A., Da Silva, A. R. A., & Weiß, C. (2015). Efficacy and effectiveness trials have different goals, use different tools, and generate different messages. *Pragmatic and Observational Research*, *6*, 47-54. https://doi.org/10.2147/POR.S89946

Poulain, T., Vogel, M., Sobek, C., Hilbert, A., Körner, A., & Kiess, W. (2019). Associations between socio-economic status and child health: Findings of a large German cohort study. *International Journal of Environmental Research and Public Health*, *16*(5), 677. https://doi.org/10.3390/ijerph16050677

Solmi, M., Radua, J., Olivola, M., Croce, E., Soardo, L., Salazar De Pablo, G., Il Shin, J., Kirkbride, J. B., Jones, P., Kim, J. H., Kim, J. Y., Carvalho, A. F., Seeman, M. V., Correll, C. U., & Fusar-Poli, P. (2022). Age at onset of mental disorders worldwide: Large-scale meta-analysis of 192 epidemiological studies. *Molecular Psychiatry*, *27*(1), 281-295. https://doi.org/10.1038/s41380-021-01161-7

Soneson, E., Burn, A.-M., Anderson, J. K., Humphrey, A., Jones, P. B., Fazel, M., Ford, T., & Howarth, E. (2022). Determining stakeholder priorities and core components for school-based identification of mental health

difficulties: A Delphi study. *Journal of School Psychology*, *91*, 209-227. https://doi.org/10.1016/j.jsp.2022.01.008

Sun, Y., Lamoreau, R., O'Connell, S., Horlick, R., & Bazzano, A. N. (2021). Yoga and mindfulness interventions for preschool-aged children in educational settings: A systematic review. *International Journal of Environmental Research and Public Health*, *18*(11), 6091. https://doi.org/10.3390/ijerph18116091

Tolbaños-Roche, L., & Menon, P. (2021). Applying the S-ART framework to yoga: Exploring the self-regulatory action of yoga practice in two culturally diverse samples. *Frontiers in Psychology*, *12*, 585300. https://doi.org/10.3389/fpsyg.2021.585300

Vago, D. R., & Silbersweig, D. A. (2012). Self-awareness, self-regulation, and self-transcendence (S-ART) : A framework for understanding the neurobiological mechanisms of mindfulness. *Frontiers in Human Neuroscience*, *6*. https://doi.org/10.3389/fnhum.2012.00296

van Agteren, J., Iasiello, M., Lo, L., Bartholomaeus, J., Kopsaftis, Z., Carey, M., & Kyrios, M. (2021). A systematic review and meta-analysis of psychological interventions to improve mental wellbeing. *Nature Human Behaviour*, *5*, 631-652. https://doi.org/10.1038/s41562-021-01093-w

Viglas, M., & Perlman, M. (2018). Effects of a mindfulness-based program on young children's self-regulation, prosocial behavior and hyperactivity. *Journal of Child and Family Studies*, *27*(4), 1150-1161. https://doi.org/10.1007/s10826-017-0971-6

Weist, M. D., Hoover, S. A., Daly, B. P., Short, K. H., & Bruns, E. J. (2023). Propelling the global advancement of school mental health. *Clinical Child and Family Psychology Review*, 1-14. https://doi.org/10.1007/s10567-023-00434-7

Wilson, S. J., & Lipsey, M. W. (2007). School-based interventions for aggressive and disruptive behavior: Update of a meta-analysis. *American College of Preventive Medicine*, *33*(2 Suppl), S130-S143.

Table 1. Children outcomes' families

Family	Outcome variable
Family 1: Negative mental health	SDQ emotional problems
	SDQ conduct problems
	SDQ hyperactivity
	SDQ peer relationship problems
	SDQ impact
Family 2: Negative self-management	CST aggressive behavior
	STRS conflict

	InCLASS negative engagement
Family 3: Positive self-management	PKBS compliance with norms
	PKBS autonomy
	InCLASS positive engagement with tasks
Family 4: Positive relationship with teachers	STRS closeness
	InCLASS positive engagement with teachers
Family 5: Positive relationship with peers	PKBS social interactions
	PKBS agreeableness
	PKBS social cooperation
	Peer acceptance
	InCLASS positive engagement with peers
Family 6: Emotional processing	Expressive emotional knowledge
	CST adaptive response
Family 7: Executive functioning	Working memory span 1
	Working memory span 2
	Cognitive flexibility

Note: Abbreviations: InCLASS, Individualized Classroom Assessment Scoring System, STRS, Student-teacher relationship scale-short form, PKBS, Preschool and kindergarten behavior scale, CST, Challenging Situations task, SDQ, Strengths and difficulties questionnaire.

Table 2. Descriptive statistics for the full sample

Measure	Statistics
Teacher characteristics	
Age in years *M (SD)*	37.1 (6.1)
Gender *N (%)*	
Male	2 (3.5)
Female	55 (96.5)

Experience as teacher *N (%)*	
Less than 1 year	3 (5.3)
Between 1 and 5 years	12 (21.1)
Between 6 and 10 years	17 (29.8)
Between 10 and 20 years	18 (31.6)
More than 20 years	7 (12.3)
Mindfulness and well-being *M (SD)*	
CHIME total score	146.0 (15.2)
WEMWBS total score	51.0 (5.8)
ESVP total score	22.6 (6.3)
Type of school *N (%)*	
School in education priority	48 (75.0)
area	16 (25.0)
Other types of school	
Children characteristics	
Age in months *M (SD)*	51.8 (3.5)
Gender *N* (%)	
Boys	360 (47.3)
Girls	401 (52.7)

Note: This table presents teacher and children characteristics. Teachers' characteristics were calculated among the 57 teachers who responded to teachers' questionnaires, except from the type of school variable. Children's age and gender data were collected at baseline, whereas teachers' age, gender, experience, type of school, mindfulness and well-being related scores were collected at endline. Schools located in education priority areas correspond to "REP" and "REP+" ("réseau d'éducation prioritaire") in France. Abbreviations: CHIME, Comprehensive inventory of mindfulness experience, WEMWBS, Warwick-Edinburgh mental well-being scale, ESVP, Satisfaction with professional life scale.

Table 3. Impact of the intervention on teacher outcomes

Variable	Control	T-C	SE	Unadj. *p*	Adj. *p*	*N*

Family: Teacher well-being						
CHIME	0.000	0.046	0.316	.884	.884	57
WEMWBS	0.000	0.144	0.238	.546	.819	57
ESVP	0.000	0.209	0.242	.387	1.000	57
Standardized Treatment Effect	0.000	0.176	0.237	.458		57

Note: Column “control” reports the mean of the dependent variable for the control group, T-C = the coefficient of the treatment indicator, SE = the standard errors of the estimated coefficient, Unadj *p* = unadjusted p-value of the estimated coefficient, Adj *p* = p-value adjusted for multiple testing, N = number of observations used in the regression. Standardized mean difference (T-C) were standardized with respect to control group so that mean in the control group is 0. Abbreviations: CHIME, Comprehensive inventory of mindfulness experience, WEMWBS, Warwick-Edinburgh mental well-being scale, ESVP, Satisfaction with professional life scale.

Table 4. Impact of the intervention on children's outcomes

Variable	Control	T-C	SE	Unadj. *p*	Adj. *p*	*N*
Family 1: *Negative mental health*						
SDQ emotional problems	0.000	-0.243	0.074	.001**	.005**	691
SDQ conduct problems	0.000	-0.145	0.057	.011*	.019*	691
SDQ hyperactivity	0.000	-0.033	0.061	.592	.592	691
SDQ peer relationship problems	0.000	-0.228	0.075	.002**	.006**	691
SDQ impact	0.000	-0.131	0.065	.045*	.057	683
Standardized Treatment Effect	0.000	-0.265	0.074	.000**		691
Family 2: *Negative self-management*						
CST aggressive behavior	0.000	-0.180	0.115	.118	.178	417
STRS conflict	0.000	-0.178	0.066	.007**	.021*	691
InCLASS negative engagement	0.000	-0.066	0.140	.635	.635	516
Standardized Treatment Effect	0.000	-0.039	0.071	.586		707
Family 3: *Positive self-management*						

PKBS compliance with norms	0.000	0.093	0.069	.176	.528	691
PKBS autonomy	0.000	0.075	0.076	.321	.481	691
InCLASS positive engagement with tasks	0.000	0.160	0.167	.339	.339	516
Standardized Treatment Effect	0.000	0.107	0.082	.194		707
Family 4: *Positive relationships with teachers*						
InCLASS positive engagement with teachers	0.000	0.014	0.181	.937	.937	516
STRS closeness	0.000	0.171	0.093	.066	.131	691
Standardized Treatment Effect	0.000	0.108	0.104	.298		707
Family 5: *Positive relationships with peers*						
PKBS social interactions	0.000	0.105	0.113	.353	.588	691
PKBS agreeableness	0.000	0.173	0.085	.042*	.208	691
PKBS social cooperation	0.000	0.095	0.094	.315	.788	691
Peer acceptance	0.000	0.007	0.085	.938	.938	620
InCLASS: positive engagement with peers	0.000	-0.085	0.133	.522	.653	516
Standardized Treatment Effect	0.000	0.033	0.078	.671		719
Family 6: *Emotional processing*						

Expressive emotional knowledge	0.000	-0.024	0.141	.863	.863	492
CST adaptive response	0.000	-0.029	0.078	.710	1.000	417
Standardized Treatment Effect	0.000	-0.010	0.103	.920		498
Family 7: Executive functioning						
Working memory span 1	0.000	0.138	0.106	.190	.571	463
Working memory span 2	0.000	-0.134	0.120	.267	.534	466
Cognitive flexibility	0.000	-0.027	0.149	.856	.856	432
Standardized Treatment Effect	0.000	-0.001	0.127	.992		470

Note: This table reports results from OLS regressions of several dependent variables on a treatment indicator and control variables. The control variables are selected by a Lasso regression of the dependent variable on all potential controls, following Belloni et al. (2014). The standardized treatment effect is a weighted average of the outcomes in each panel of the table, and is constructed following Anderson (2008). Column “control” reports the mean of the dependent variable for the control group, T-C = the coefficient of the treatment indicator, SE = the standard errors of the estimated coefficient, Unadj p = unadjusted p-value of the estimated coefficient, Adj p = p-value adjusted for multiple testing, N = number of observations used in the regression. Standardized mean differences (T-C) were standardized with respect to the control group so that the mean in the control group is 0. Abbreviations: InCLASS, Individualized Classroom Assessment Scoring System, STRS, Student-teacher relationship scale-short form, PKBS, Preschool and kindergarten behavior scale, CST, Challenging Situations task, SDQ, Strengths and difficulties questionnaire. *Significant at the 5% level. **Significant at the 1% level.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Suppl.Materials4.pdf