

# Mindfulness

## in the Education System

### Effects of Two Different Mindfulness-Based Trainings in Pre- and Elementary School



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## Summary

Nowadays, our attention is considered a central currency of the present. If we do not pay attention and are not mindful, we miss out 50 % of our lives (Jha, 2021). As you read this thesis, how much attention will remain on reading, how often will you be interrupted by digital distractions, a message on your smartphone, a thought that prompts an action. From a survival perspective, our brains are made to be distracted in order to notice danger. However, the dangers of the current time have changed significantly, and survival stress is not always useful. New studies since COVID-19 show distress and negative mental health outcomes in children and adolescents like high prevalence of anxiety and depressive symptoms (Deolmi & Pisani, 2020; Imran et al., 2020). This is where mindfulness can make a difference and why it may be worth starting at a young age.

Therefore, the goal of this thesis was to gain further insights into the effects of mindfulness-based interventions (MBIs) in early German educational settings. Two different MBIs were conducted: The first project with preschoolers and the second project with elementary school children. This thesis aims to investigate specific effects of mindfulness training on different concepts such as cognitive or emotional-social domains, which are relevant to developmental progress, social skills, and mental health.

In the first study with preschoolers, we investigated the effects of an eight-week mindfulness-based Kindness Curriculum (KC), a specially developed program for 3-6 years old preschoolers, on Executive Functions (EFs) and socio-emotional competencies (Portele et al., 2023). From three German kindergartens, 69 preschoolers participated. 38 children (age:  $M = 5;3$  (year; months),  $SD = 0;8$ ) were included in the mindfulness training group and 31 (age:  $M = 5;3$ ,  $SD = 0;7$ ) in the wait-list control group. Before and after the eight weeks of mindfulness lessons, EFs were measured with the Go-No Go and Flanker tasks. Socio-emotional functions were examined with an assessment of emotional competencies (EMK 3-6). The results showed a significant improvement in emotional and social abilities for the mindfulness group over the

control group when the pretest results were integrated into the analysis. However, the mindfulness group showed no better performance concerning EFs (inhibition) than the control group. This study indicates improved emotional competencies through a mindfulness program including heartfulness-based exercises, like exercises of gratitude and sharing with others, in preschoolers. Further studies could evaluate if different forms of mindfulness training in preschool settings can enhance different aspects of preschoolers' development.

Based on our results, we speculated that the specific content of the intervention, such as heartfulness-based mindfulness, determines which domains of human experience and behavior are impacted by the intervention. Accordingly, we investigated in our second study conducted with elementary school students, if a six-week mindfulness-based tool, the Mindfulness Education Workbook, which integrates the five topics emotion regulation, inhibition, physical self-concept, resources, and connectedness to nature, has a specific effect on the outcomes (Portele & Jansen, 2023). Furthermore, we explored whether a different number of hours of mindfulness teaching effects distinct outcomes. Ninety-one children from a public elementary ( $M$  age = 9.74 years,  $SD$  = 0.76) participated and were divided into three groups according to their respective school classes. The intervention group was divided into two groups: (a) mindfulness-plus and (b) mindfulness. The mindfulness-plus group repeated one exercise daily in addition to the biweekly training, which was completed by both intervention groups. A passive control group received the standard school day instruction. The five concepts of emotion regulation, inhibition, physical self-concept, resources, and connectedness to nature were measured before and after the mindfulness intervention. The variables of the FEEL-KJ for the adaptive strategies in total as well as for their comprising emotions anger, fear, and sadness, separately, revealed a significant effect ( $p < .05$ ) for the measurement of emotion regulation in favor of the two mindfulness groups compared with the control group. Solely for the subscale mood elevation, the mindfulness-plus group showed significantly higher scores than the control group. Both, mindfulness-plus and mindfulness group varied from the control group on the

measure of emotion regulation strategies, however not on the other four domains that were assessed (self-reports of resources, physical self-concept, and connectedness to nature as well as a mental task assessing inhibition). There was no evidence that the additional practice in the mindfulness-plus group significantly added to the intervention's effectiveness.

The Mindfulness Education Workbook is a promising tool for elementary schools. Follow-up studies may be able to give further insights into the various effects of offering mindfulness training in schools. In particular, further research with objective markers may also be able to investigate the effects of individual aspects, which are subsumed under the umbrella term mindfulness in more detail.

The following can be summarized as the overarching findings of these two studies despite differences in programs and age groups: In the socio-emotional domains, most significant changes were seen in the groups that received a MBI compared with the control groups. Raising compassionate, empathetic, and thoughtful generations of young children is as important as academic development. Socio-emotional development can be seen as the crux of our society. The results of these scientific studies could reinforce to education policymakers the importance of socioeconomic-emotional development and thus lead to increased integration into the kindergarten and school curriculum.

## 1 Preface

Happy teachers change the world

Thich Nhat Hanh

and I would like to add: ...and happy children do, too.

If mindfulness-based interventions (MBIs) may be able to make a small contribution to this, then it is worth the effort and as Richard Davidson once said: The earth would be a different place if we spent the same short time caring for our minds as we do brushing our teeth.

“Being kind to yourself is one of the greatest kindnesses”, said the mole.

Extract from the book *The Boy, The Mole, The Fox and The Horse* from Charlie Mackesy

This statement from the book *The Boy, The Mole, The Fox and The Horse* should not be understood in an egocentric sense, but that one's own kindness towards oneself in a first step can enable being honestly kind towards other people and in a second step being connected with nature and the world. Instilling this knowledge in our children at an early age may be a good foundation for a meaningful life and consequently a better world.

Some people might argue that children can even live more in the moment than we adults can and therefore, children don't need mindfulness. In a first train of thought, this may seem true. However, considering the fact that humanity as a community is facing a climate crisis, biodiversity extinctions, systematic racism, wars in the neighborhood, and global pandemics to mention some of the big challenges of the current time (Hawkins & Burke, 2021) mindfulness, among others, could be a good support for children. Already in 2015, Steffen et al. highlighted the planetary boundary framework, which points out many threats to our planet. The fast-changing world with its accumulating challenges and its accelerating lifestyle especially demand that educational systems change appropriately to equip young and upcoming

generations with the tools necessary to not only face those challenges but to also live well and be healthy. Combining and balancing heart, mind, and body to cultivate wisdom, compassion, and well-being in addition to intelligence, is essential if one is to think in more naturalistic, holistic, and integrative ways (Hawkins & Burke, 2021), which should be a goal of education. An urgently needed change in focus may be required to create healthier, school eco systems whose learning atmosphere is characterized by well-being. Dahl et al. (2020) crystallize four core dimensions of well-being: awareness, connection, insight, and purpose. Mindfulness-based training could enhance these components. Mindfulness with adults can for example lead to better mental health, self-care, and job satisfaction (Jiménez-Picón et al., 2021) and is the best predictor of psychological distress (Conversano et al., 2020). In a systematic review among healthcare professionals, the studies declared a positive relationship between mindfulness and emotional intelligence, in particular emotion regulation, and a negative relationship to emotional exhaustion (Jiménez-Picón et al., 2021). Therefore, mindfulness could be attributed a protective role. Under these described circumstances it seems obvious to teach children, besides school subjects, abilities how to influence their lives, how to be happy, how to arrange with difficult situations or as a metaphor *waves* – in the words of Jon Kabat Zinn. You can't stop the waves, but you can learn how to surf. One goal of this work is to teach children to surf, in other words, to provide them with skills that may help them to better deal with smaller and larger waves in their lives. This thesis attempts to gain more insight into the effect mechanisms of mindfulness in mindfulness-based programs in children.

## **2 Theoretical Background and State of Research**

### **2.1 The Concept Mindfulness – an Attempt of a Definition**

Mindfulness describes a particular way of paying attention and the ability to be aware of what arises through paying attention in that way (Kabat-Zinn, 2013). It elevates the awareness that is already present in every human being and sometimes needs to be consciously awakened again. On purpose, non-judgmentally, and in the present moment. This or similar definitions of mindfulness, from Kabat-Zinn (1994), are frequently cited in the modern scientific field of mindfulness research (Gethin, 2015). Bishop et al. (2004) are also often cited suggesting a two component model of mindfulness: self-regulation of attention and orientation to experience. The first component involves maintaining the attention on the immediate experience. The second component involves a particular orientation to the present moment characterized by curiosity, openness, and acceptance.

The Mindfulness-Based Stress Reduction (MBSR) program is one of the most widespread mindfulness training programs (Hölzel, Carmody, et al., 2011). Jon Kabat-Zinn developed MBSR originally for the clinical setting over 40 years ago, as an eight-week program for patients with severe chronic pain issues (Kabat-Zinn, 2013). Modified forms, for example Mindfulness-Based Cognitive Therapy (MBCT; Segal et al., 2002), and Mindfulness-Based Compassionate Living (MBCL; van den Brink & Koster, 2015) were further developed. Nowadays, MBSR is even used in subclinical settings or organizations to reduce stress, and health insurances cover proportionate costs of those stress management programs. Through the purview of MBSR, Kabat-Zinn increasingly brought the topic area of mindfulness to the Western world. The Buddhist roots deliberately barely matter in the MBSR class, as the benefits of mindfulness practice are to be made accessible to a broader range of people regardless of religious beliefs and without an ideological superstructure. However, to gain a deeper understanding of the concept of mindfulness, the development of the term, and its Buddhist origins should be briefly discussed.

Mindfulness is a translation of the Pali term *sati* or from Sanskrit *smṛti* meaning something like ‘to be mindful’ and containing as well ‘to remember’ (Grossman & van Dam, 2011). In 1881, T.W. Rhys Davids probably first applied the translation of the technical term *sati* to the English word mindfulness. Since this time, many authors, reading and interpreting the ancient Buddhist texts, have tried to define what exactly mindfulness means (Gethin, 2011).

From a Buddhist perspective there are three pillars of the *dhamma* (Buddha’s teaching): *dana* (generosity), *sila* (ethics and morality), and *bhavana* (meditation and mindfulness). Mindfulness is seen as one part of the bigger *dhamma*. It is important to conjunct it with other supportive practices such as compassion, gratitude, acceptance, etc. (Pemararana & Khong, 2021). In early Buddhist texts the practice of mindfulness is one of a number of cultivated qualities for Buddhist monks leading to the Buddhist path of ‘enlightenment’ and ‘awakening’ (Gethin, 2015). Gethin (2015) refers to various lists – translated all from Sanskrit – in which mindfulness is included. For example, the five basic faculties: faith, vigor, mindfulness, concentration, and wisdom. Mindfulness is as well one of the seven constituents of awakening: investigation of *dhamma*, mindfulness, vigor, joy, tranquility, concentration, and equanimity. Besides, it is part of the eightfold path, the Buddha’s practical instructions to reach the end of suffering: right view, right intent, right action, right speech, right livelihood, right effort, right mindfulness, and right concentration.

In conclusion, in the early Buddhist texts, mindfulness does not have a stand-alone feature, but is part of a larger entity. In those texts there is little information about an explicit definition. Grossman and van Dam (2011) point out major differences in the understanding of the concept between Buddhist scholars and Western scientists. Western scientists often aim to find clear definitions of mindfulness and its facets whereas the Buddhist view is rather a process and a way of being. Despite the contextual complexity and the criticism of the different definitions of the term (Grossman & van Dam, 2011), and the obvious different practice of mindfulness in the Western world, the positive aspects that many people experience through

mindfulness exercises should be given attention. Maybe, the discussion about the concept mindfulness can be compared to the metaphor: Several doors lead to one (or to a similar) room. Therefore, scientific research and further gain of knowledge is relevant to identify the several doors.

## **2.2 Mindfulness from a Neuroscientific Perspective**

The need for a theoretical framework was increasingly requested. Hölzel, Lazar, et al. (2011) propose distinct but interacting components describing the mechanisms of mindfulness by integrating a neuroscientific perspective. The four components are attention regulation (e.g., sustaining attention on the chosen object), body awareness (sensory experience of breathing, emotions, or other body emotions), emotion regulation (split into reappraisal; exposure, extinction and reconsolidation), and change in self-perception (detachment from identification with a static sense of the self). The associated brain region for attention regulation is the anterior cingulate cortex. Body awareness is associated with the insula and the temporo-parietal junction. The reappraisal part of emotion regulation is associated with the (dorsal) prefrontal cortex (PFC), whereas the exposure, extinction and reconsolidation parts of emotion regulation are associated with the ventro-medial PFC, the hippocampus, and the amygdala. The fourth component, change in self-perception, is associated with activations in the medial PFC, the posterior cingulate cortex, the insula, and the temporo-parietal junction. Michaelsen and Esch (2021) refer to those four effect mechanisms (attention regulation, body awareness, emotion regulation, and self-awareness) and consider them as levels of experience or practice that can be interpreted in terms of a learning continuum or stage model. Thus, attention regulation may be seen as the first stage or precondition for the other three components.

Hölzel, Carmody, et al. (2011) compared anatomic magnetic resonance imaging (MRI) images from sixteen healthy, meditation-naïve participants after a MBSR program with seventeen participants of a wait-list control group. The results suggest increases in brain gray matter concentration within the left hippocampus after the MBSR course. Exploratory whole



brain analyses showed additional increases in the posterior cingulate cortex, the temporo-parietal junction, and the cerebellum. Those brain regions are involved in learning and memory processes, emotion regulation, self-referential processing, and perspective taking. Gotink et al. (2016) obtained similar findings regarding increased activity, connectivity, and volume in the prefrontal cortex, insula, and hippocampus, and decreased activity in the amygdala.

In their theoretical developmental social cognitive neuroscience perspective in early childhood Zelazo and Lyons (2012) suggest the following assumptions: Self-regulatory skills and socio-emotional competence evolve in response to changes in a dynamic interaction between more top-down (controlled) regulatory processes and more bottom-up (automatic) influences on behavior. MBIs including age-appropriate activities may be able to foster the maturation of self-regulation by targeting top-down processes as well as mitigating bottom-up influences such as fear, stress, and curiosity. Hence, MBIs in early childhood may create conditions that encourage thinking, both in problem solving and in a playful, exploratory way. In general, a lack of understanding the neurobiological mechanisms underlying mindfulness in youth can be noted (Marusak et al., 2018). Marusak et al. (2018) found in their study with 42 children and adolescents (ages 6-17) that mindfulness in youth is associated with functional neural dynamics and interactions between neurocognitive networks.

### **2.3 Measurements of Mindfulness**

As mindfulness has received increasing interest in the scientific context, many researchers aimed to make the concept measurable, in other words from the conceptualization to the operationalization. In Western psychology, various self-report questionnaires were developed, e.g., the Mindfulness Attention Awareness Scale (MAAS; Brown & Ryan, 2003), the Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004), the Five Facets of Mindfulness Questionnaire (FFMQ; Baer et al., 2006), the Toronto Mindfulness Scale (TMS; Lau et al., 2006), the Developmental Mindfulness Survey (DMS; Solloway & Fisher, 2007), and the Interpersonal Mindfulness Scale (IMS; Pratscher et al., 2019).

About eight years later, the first tests for children and adolescents were developed. In some cases, adapted children's versions were created from the adult versions. Saunders and Kober (2020) point out, that there are still fewer tests for children and adolescents. However, four at least tentatively in peer-review journals validated self-report scales are applied: The Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011), the Mindful Attention Awareness Scale for Adolescents (MAAS-A; Brown et al., 2011), the Mindful Attention Awareness Scale for Children (MAAS-C; Lawlor et al., 2014), and the Comprehensive Inventory of Mindfulness Experiences – Adolescents (CHIME-A; Johnson et al., 2017). For a detailed overview and description of mindfulness measures in children and adolescents see Goodman et al. (2017). Most recently, a handbook of assessment in mindfulness research (Medvedev et al., 2022) has been published providing the necessary background for making informed decisions about mindfulness measurements and relevant outcomes. Differences between trait and state mindfulness are discussed and combined with appropriate statistical methods. Various scales for the child and youth sector are explained in individual chapters.

All questionnaires in the mindfulness domain, regardless of the target age group, are self-reported measurements. Therein lies a common criticism of measurement tools for mindfulness and whether they can actually measure aspects of mindfulness, when mindfulness is a construct that is difficult to define (Grossman & van Dam, 2011; Saunders & Kober, 2020). The authors present several critical considerations for measuring mindfulness. For the following two reasons we decided to examine distinct concepts on which mindfulness might have an effect, instead of using one questionnaire specifically for mindfulness. It is even less verified for children, that self-report scales for mindfulness provide meaningful results (Saunders & Kober, 2020), and only the CAMM-C has been tested for children younger than 10 years (Lawlor et al., 2014).

## 2.4 Differences in Teaching Mindfulness to Children

Mindfulness with children. Some people might think, do children even need mindfulness? Don't children live more in the moment than adults, can forget themselves and the world around them while playing? A rapidly changing world with ever-changing global challenges and the access to digital media that without responsible use often distracts and scatters concentration to mention some reasons to introduce children to mindfulness-based practices (Goleman & Senge, 2014; Schonert-Reichl & Roeser, 2016). The COVID-19 pandemic itself brought high rates of depression, anxiety, and post-traumatic symptoms for children of all stages of development (Marques de Miranda et al., 2020). Long-term psychological consequences cannot yet be assessed, emphasizing the need for low-threshold interventions that can be integrated into everyday life and may protect children from long-term consequences of adverse life events.

Saunders and Kober (2020) emphasize to consider the aphorism “kids aren’t just small adults” in dealing with mindfulness interventions. Therefore, implementing and developing mindfulness-based programs for children demands thoughtful consideration. The authors suggest possible features for child-specific adaptations as the dose of meditation, treatment duration, meditation style, and home exercises. As already discussed, there is no clear consensus on the definition of mindfulness. “Classic” mindfulness exercises with children, in the sense of paying attention and focusing on a particular object, for example breath or sensations of the body, are often performed in a shorter format and in a more playful manner due to shorter concentration spans. Zelazo and Lyons (2012) also devote a section of their article to adapting mindfulness practices for children and adolescents and share many points with our perspective. Hence, mindfulness interventions for children over several weeks integrate far more exercises on equally important concepts, such as gratitude, dealing with emotions, friendship, communication, loving-kindness, and connectedness. Possibly this could be linked with the Buddhist view, where mindfulness is seen as one component of a larger canon of

qualities (Gethin, 2015). Implementation of and access to mindfulness interventions for children can be facilitated by integrating programs into the educational system. In Germany it requires compulsory education for children from elementary school onwards, and it should be pointed out which programs already exist to date. Because the two studies for this thesis were examined in preschool and elementary school, the focus is set to those educational settings.

## **2.5 Mindfulness in the Education System**

The research field concerning mindfulness gained in popularity with an exponentially growing number of publications (van Dam et al., 2018). The results of a systematic search from the years 2000 to 2014 for peer-reviewed publications on the topic of mindfulness in the education system also confirmed a rise in this field (Schonert-Reichl & Roeser, 2016). Especially since the year 2009, there has been a steady increase in publications. Interestingly, nearly half of the articles were theoretical or review articles, and solely 15 % of the studies were conducted in either preschool or elementary school settings.

The education system has its own relevance. Children learn and are educated, who will later play a decisive role in determining the future. At the same time, we don't know what this future will look like and what skills are really required. Recurrently, calls are made for the German education system to be better prepared for contemporary challenges of the twenty-first century and to teach more life skills. Knowledge acquisition and growth is an important part of the education system. However, beside knowledge acquisition, many other important skills such as mindful, compassionate communication, gratitude, self-regulation, knowledge and feelings about the body and mind are helpful to prepare children for a fulfilling life. Many of the skills mentioned above are often part of mindfulness-based programs.

Various programs that incorporate the concepts of mindfulness, mindfulness-based awareness, social and emotional learning, or similar constructs, have been developed especially for the educational context. The programs, in their diversity, underlie a commonality:

Supporting children in cultivating a sense of well-being so they may thrive and flourish in the daily hustle (e.g., Schonert-Reichl et al., 2015).

To date, several studies with different age groups have investigated various mindfulness programs for preschool children (e.g., Bernay et al., 2016; Flook et al., 2015; Kim et al., 2020; Thierry et al., 2016; Thierry et al., 2018), primary or elementary school children (e.g., Amundsen et al., 2020; Bernay et al., 2016; Janz et al., 2019; Kang et al., 2018; Schonert-Reichl & Lawlor, 2010; van der Oord et al., 2012), school-aged adolescents (e.g., Sapthiang et al., 2019; Wilde et al., 2019), and university students (e.g., Hindman et al., 2015; Jain et al., 2007; Lynch et al., 2011; Lynch et al., 2018; Regehr et al., 2013).

### ***2.5.1 Preschool Settings***

Mindfulness is also receiving a lot of attention in the field of early childhood (Flook et al., 2015; Kim et al., 2020; Thierry et al., 2016). Because the terms preschool and kindergarten have internationally seen different meanings, here, preschool and kindergarten are used interchangeably as synonyms. In Germany it refers to the period before elementary school, the children are usually between 3 and 6 years old, it is not compulsory, and there are no grades in kindergarten.

Establishing mindfulness at an early age in childcare centers could serve as the basis for creating a safe, flourishing, and potential-awakening space for learning and knowing. However, while there are some meta-analyses on MBIs in schools (e.g., Carsley et al., 2018; Zenner et al., 2014), reviews and meta-analyses on preschoolers are scarce. To our knowledge there exist considerably fewer programs for preschoolers than for older children. In a recent review (Bockmann & Yu, 2022), 18 studies with preschool children between 3-6 years were identified to investigate MBIs in supporting emotional, behavioral, and cognitive self-regulation. The results demonstrate that teachers considered the interventions to be feasible and acceptable. The effects of the 18 studies were mixed, but the impact was significantly more meaningful for

indigent children. The authors conclude MBIs as a safe way to foster healthy environments from a social and emotional perspective for young children. However, they also infer a vast variety of programs around the globe. Across the 18 studies identified in this review, 15 different programs were established. The mindfulness interventions differ from yoga-based mindfulness interventions to interventions that were compared with socio-emotional learning elements and those focusing on mind-body awareness. Furthermore, other unique characteristics (intervention components, duration, and frequency) made it difficult to determine which characteristic of each program support emotional, behavior or self-regulation.

Two of these programs are the MindUP curriculum (Thierry et al., 2016; Thierry et al., 2018) and the mindfulness-based Kindness Curriculum (KC) (Flook et al., 2015). In the study with the MindUP program (Thierry et al., 2016) children showed enhanced Executive Functions (EFs) based on a teacher rating. The Behavior Rating Inventory of Executive Function for Preschoolers (BRIEF-P; Gioia et al., 2002) consists of 63 items. Teachers and parents assessed the extent to which a behavior represented a problem for the student.

In their first study implementing the KC, Flook et al. (2015) investigated various components such as EFs, using the delay of gratification, Dimensional Change Card Sort and Flanker task. Furthermore, social competences were evaluated with a sharing task and the Teacher-rated Social Competence scale (TSC) as well as the academic performance in the form of school grades. Sixty-eight preschool children participated with a mean age of 4.67 years ( $SD = .27$ ), 30 children were assigned to the mindfulness group and 38 to the wait-list control group. The sample size consisted of seven classrooms from six different elementary schools within a public school district. 37.9 % are considered socioeconomically disadvantaged. The mindfulness group received 20-30 min mindfulness lessons twice a week over a period of 12 weeks. The results showed significant improvements for the mindfulness group in the TSC total score and in the subscale emotion regulation. Furthermore, it was shown that children from the control group acted more selfishly in the sharing task and thus shared less. Regarding the school

grades in the following subjects *approaches to learning, health and physical development and social and emotional development*, the KC group showed improved performance compared with the control group. No differences between groups were found regarding cognition and general knowledge or language development and communication. With respect to measures of EFs, both groups showed improvements in the Flanker task, with larger effect sizes for the control group ( $d = 0.64$ ; KC group  $d = 0.47$ ). This difference was not statistically significant. Thus, it can be concluded that the mindfulness training did not specifically improve inhibitory control. However, for children with lower social competence and lower executive functioning (inhibitory control and cognitive flexibility) at baseline, the KC intervention led to greater benefits in social skills compared with children of the control group. At baseline, both children in the control and in the intervention group were similarly low on EFs. The following two chapters relate particularly to the concepts investigated in the first study of this thesis in preschool setting.

### **2.5.1.1 Mindfulness and the Development of Executive Functions**

The umbrella term EFs refers to important cognitive mechanisms and control functions and has gained increased scientific interest over the last three decades. Miyake et al. (2000) rely on three particularly important EFs frequently cited in literature, namely, (a) working memory, conceptualized as *updating* and monitoring working memory processes; (b) cognitive flexibility, which means a rapid switching or *shifting* between tasks and thought processes; and (c) *inhibition*, the ability to react to relevant and to suppress irrelevant stimuli. The three subsystems are distinguishable, but also mutually interrelated (Röthlisberger et al., 2010). Mindfulness can promote some of these EFs, among others (Flook et al., 2015). If attention and awareness are directed for example to the breath, it is already a form of mindfulness to notice the wandering of the thoughts away from the breath, which can be assigned to abilities of the working memory. The friendly redirection of attention to the given object, in this example the breath, falls under cognitive flexibility (Flook et al., 2015). With increased mindfulness-based

practice the fading out of irrelevant stimuli and consequently the improvement of inhibition skills can be promoted.

The main components of EFs develop during childhood and preschool. Thus, they form an essential cornerstone to enable the development of higher cognitive processes in adulthood (Garon et al., 2008). In a systematic review, Jansen et al. (2016) summarized the influence of MBIs on EFs in childhood. Overall, MBIs yielded improvements in attention, inhibition, cognitive flexibility, and working memory compared to control groups – mainly wait-list control groups. However, in a study by Schonert-Reichl et al. (2015), elementary school children from the mindfulness group showed significantly better scores in the Flanker task compared to an active control group receiving a *business as usual* (BAU) social responsibility program. Well-developed EFs do not only bring benefits on cognitive functioning. EFs appear to be a predictor of school success (Röthlisberger et al., 2010) and are also associated with academic achievement and life success (Blair & Razza, 2007). In addition, researchers attribute a significant influence on key developmental outcomes to EFs (Zelazo et al., 2013). Well-developed EFs lead to effective self-regulation (Viglas & Perlman, 2018) and emotion regulation (Flook et al., 2015). For example, if a child has difficulties controlling his or her aggressive impulses, this has a problematic effect on a stable foundation for good socioemotional development. Therefore, mindfulness interventions may also support the development of adaptive emotion regulation skills.

### **2.5.1.2 Mindfulness and Socio-Emotional Development**

Emotion knowledge is an important first step in learning what's going on inside oneself, how emotions arise, why they exist, how they help human beings to survive. If children understand their own emotions better, if they can perceive and communicate about them, this in turn has a beneficial effect on their relationships with others. The early development of universal, i.e. cross-cultural, primary emotions or basic emotions such as sadness, joy, anxiety, and anger requires interactions with caregivers, whereas secondary emotions such as shame,



pride, and guilt require some self-reflection and awareness of socially accepted norms of behavior (Petermann & Gust, 2016).

Cole et al. (2004) point out the lack of consensus regarding the definition of emotions and the ambiguities regarding the use of the term emotion regulation. Nevertheless, they attempted to establish a working definition: “Emotion regulation refers to changes associated with activated emotions” (Cole et al., 2004, p. 320). Emotion regulation can describe two regulatory phenomena: Emotions as regulating and as regulated. In some studies, emotion regulation can be understood as a way of how emotions adjust psychological processes. In other studies, emotion regulation can be defined as the individual differences in emotional self-regulation. Viglas and Perlman (2018) showed that preschool children from the group receiving the Mindful Schools Program showed greater improvement in self-regulation and acted more prosocial and less hyperactive than the control group. Despite the broad range of different definitions and studies of this term, we focus in our study on emotion regulation as the ability of preschool children to find helpful strategies for regulating and dealing with positive and negative emotions (Petermann & Gust, 2016).

One ability which is often discussed in relation to mindfulness is empathy. There is also no uniform definition for the concept empathy (Cuff et al., 2016). Empathy can be defined as one's affective response to another person's emotional state that is identical or similar to what the other person is feeling. This reaction is based on an understanding of the other person's state or condition (Eisenberg et al., 2007). Hence, empathy can regulate relationships and enhance cooperation and group bonding (Rieffe et al., 2010). Closely related to empathy is prosocial behavior. One definition of prosocial behavior is an intentional and volitional action that potentially or actually contributes to the welfare of another person (Bierhoff, 2010). Both concepts may be promoted through MBIs.

To summarize, EFs provide a foundation for good socioemotional behavioral development. Jansen et al. (2016) recommend promoting EFs as early as possible in terms of

holistic training sessions such as mindfulness-based practices that train both emotion and cognition. The KC (Healthy Minds Innovations, Inc., 2017), among others, offers a good opportunity to train various components and is therefore used in the first study of this thesis.

### **2.5.2 Elementary Schools**

The elementary school period in the German school system comprises four years and is compulsory. As of now, several programs for elementary school-age children exist, for example, Mindfulness-Orientated Meditation for primary school children (Crescentini et al., 2016), a Still Quiet Place (Saltzman, 2014), Paws b (ages 7-11), the Mindfulness in Schools Project (Vickery & Dorjee, 2016), MindUP (Hai et al., 2021), the Mindful Education Workbook (Rechtschaffen, 2016), Learning to BREATHE for K-12 (Broderick, 2021), the Inner Kids program developed by Susan Kaiser Greenland (Flook et al., 2010), CalmSpace (Janz et al., 2019), the Living Mindfully Programme (Amundsen et al., 2020), and the Gaia program (Ghiroldi et al., 2020).

At the current state of research, there exist few meta-analyses and reviews (Carsley et al., 2018; Felver et al., 2016; Zenner et al., 2014; Zoogman et al., 2015) addressing MBIs. They provide an overview of existing intervention studies and their effects on various outcomes in the school setting. In one of the first meta-analyses, Zenner et al. (2014) consider MBIs as auspicious interventions, particularly in improving cognitive performance ( $g = .80$ ), stress and coping ( $g = .39$ ), and resilience ( $g = .36$ ) compared to control groups. Emotional problems and third-person ratings were not statistically significant. In another meta-analysis concerning mindfulness interventions' effectiveness regarding mental health in schools, 24 studies with a total of 3977 participants were included (Carsley et al., 2018). A small to moderate effect on mental health and well-being could be shown. In general, however, a large heterogeneity of the studies is evident. There are, for example, differences in sample size, length of intervention, program type, at-home practice, trainer experience with mindfulness, and whether the

intervention was delivered by outside facilitators or educators or teachers from school. Generally, it is of great importance that the person teaching mindfulness is comfortable with the exercises and is practicing mindfulness on his or her own (Hooker & Fodor, 2008). Many authors call for further research to explore specific good and effective practices and to scientifically support and relativize the hype about mindfulness in the general population (e.g., Greenberg & Harris, 2012; van Dam et al., 2018). In a recent meta-analysis, for example, the effectiveness of mindfulness interventions in primary and high schools on anxious and depressive symptoms is questioned (Phillips & Mychailyszyn, 2022). For this, the requirement to relativize the mindfulness hype can also be applied to children.

#### **2.5.2.1 Mindfulness and the Concepts of Physical Self-Concept, Inhibition, Emotion Regulation, Resources, and Connectedness to Nature**

In the second study of this thesis the Mindful Education Workbook (Rechtschaffen, 2016) [Die achtsame Schule (Rechtschaffen, 2018)] was the employed mindfulness program for the elementary school setting. For further descriptions see 5.1.2 Interventions. Rechtschaffen (2018) underlines five literacies building up on each other: Physical, mental, emotional, social, and global literacy. This classification matches to a large extent with the mechanisms of mindfulness according to Hölzel, Lazar, et al. (2011): Cognitive (attentional), bodily, emotional, and perspective-changing abilities (see chapter 2.2 Mindfulness from a Neuroscientific Perspective). Michaelsen and Esch (2021) support the staged structure and see the components as essential in educational institutions. Therefore, the following sections attempt to relate the five literacies examined in this study to the results of the current state of research according to the concepts of physical self-concept, inhibition, emotion regulation, resources, and connectedness to nature. Across all variables, the following studies exemplify once again the heterogeneity of the studies and the different outcomes investigated.

**Physical Literacy: The Physical Self-Concept.** As of now, no study has investigated the influence of mindfulness training on bodily-based processes, such as interoception. In one

pilot study, the effect of yoga training was investigated with regards to the physical self-concept (Richter et al., 2016), including the perception of one's body. Yoga can be described as a mindful form of movement (Jansen et al., 2019). The study of Richter et al. (2016) compared a yoga group ( $n = 10$ ) with a physical skill training group ( $n = 7$ ) regarding several aspects. Differences between yoga group and physical training group were significant in post-pre differences in the category speed of the physical self-concept questionnaire (PSK-K) for children. In contrast to the physical skills in the training group, that depicted an increase, in the mean perceived speed in the PSK-K, the yoga group depicted a decrease. The physical self-concept is relevant because it is, among others, related to general self-concept: The objective of Del Palomino (2017), for example, was to parse the level of self-concept in disadvantaged elementary school children when entering the education system. The multidimensional self-concept scale contains seven dimensions: academic self-concept in mathematics, language, general academic self-concept, physical ability, physical appearance, peer relations, and parent-child relations. The results of this descriptive-correlational study with an increase in positive levels of self-concept in peer relations, physical appearance and physical ability self-concept, and academic self-concept in mathematics argue for the implementation of an appropriate mindfulness program.

**Mental Literacy: Executive Functions (Inhibition).** With regard to cognitive processes, a systematic review described the generally positive impact of MBIs on EFs in studies published until 2015 (Jansen et al., 2016). The result of the review was confirmed by further studies: Janz et al. (2019) showed improvements of 55 six-year old elementary school children in cognitive flexibility (Dimensional Change Card Sort Task) and inhibition skills (Flanker Task) after the mindfulness intervention CalmSpace compared with a wait-list control group ( $n = 36$ ). This result was confirmed by teacher reports. Another study examined effects of a 10-week mindfulness training using mindfulness principles and elements of MBSR on sustained and selective attention (Tarrasch, 2018). The mindfulness group, consisting of 58

elementary school children in total but small delivering groups of 3-4 students, showed a significant improvement in both attention tasks compared to a control group with 43 students. The study of Schonert-Reichl et al. (2015) investigated the effectiveness of MindUP (an SEL program with mindfulness practices) on EFs, stress regulation, social-emotional competence, and school achievement in 9-11-year old children ( $n = 48$ ). The results were compared to an active control group ( $n = 51$ ) obtaining a business as usual (BAU) social responsibility program. For the MindUP group in comparison to the BAU group, significant improvement in EFs, self-report measures of well-being, self- and peer-reported prosocial behavior, and a tendency to better math performance could be shown. The results of cortisol measurements were ambiguous and different interpretations are possible.

**Emotional Literacy: Emotion Regulation, and Social Literacy: Resources.** The emotional and social literacies are considered together, because there were no studies explicitly for resources. Regarding emotional abilities, the practice of mindfulness was associated with a healthy emotion regulation (Roemer et al., 2015); however, another study did not note significant improvement in emotion regulation (Amundsen et al., 2020). Amundsen et al. (2020) examined the effectiveness of a 6-week mindfulness program (Living Mindfully Programme, United Kingdom) for 9- to 10-year-old children on outcomes such as well-being and emotion regulation. Teachers were trained and delivered the program as part of their school curriculum. 64 children were assigned to the treatment group, 19 to the active control group, and 25 to a wait-list control group. Compared with the wait-list control group, children in the mindfulness group improved significantly in mindfulness ( $d = .76$  and  $.77$ ), positive outlook ( $d = .55$  and  $.64$ ) and life satisfaction ( $d = .65$  and  $0.72$ ) immediately after the intervention and at a 3-month follow-up. Compared with the active control group, which received a quasi positive psychology intervention, the effects remained, however in a reduced form. There was no significant improvement regarding emotion regulation. A further study examined an 8-week mindfulness program (Paws b) for children ages 7 to 9 years offered by teachers within a regular school

curriculum (Vickery & Dorjee, 2016). Thirty-three children participated in the mindfulness and 38 in the control group; measurement time points were at baseline, posttest, and three months follow-up. Results showed a high acceptance and enjoyment of training (76 %). A decrease ( $p = 0.010$ ,  $d = 0.84$ ) in negative affect at follow-up could be demonstrated in favor of the mindfulness group. Meta-cognition improved significantly at follow-up based on teachers' but not on parents' reports with a large effect size ( $p = 0.002$ ,  $d = 1.08$ ). Crescentini et al. (2016) investigated effects on attention and psychological well-being of an 8-week training comparing a mindfulness-oriented meditation (MOM) group ( $n = 16$ ) with an active control group ( $n = 15$ ) which received a training focused on emotion awareness. The same instructors delivered both trainings three times per week. For the children participating in the MOM group, teacher reports showed a reduction in attention problems. The children's self-report measures in each group did not indicate a reduction in depressive symptoms. Furthermore, both trainings reduced internalizing emotional problems. In another study, van de Weijer-Bergsma et al. (2012) assessed the effectiveness of an elementary school-based mindfulness intervention for 8- to 12-year-old children. Children from three schools were randomized to an intervention ( $N = 95$ ) or a wait-list control group ( $N = 104$ ). Children receiving the 6-week MindfulKids training showed only a few primary prevention effects on stress and psychological well-being directly after the intervention. At follow-up (7 weeks after posttesting), more effects were found. Compared with the pretest, there was a significant increase in child-reported differentiation of emotions, verbal sharing of emotions, bodily awareness, not hiding emotions, and sense of coherence, and a significant decrease in rumination and analyzing emotions. Furthermore, anxiety and angry/aggressive behavior reported by parents declined significantly.

**Global Literacy: Connectedness to Nature.** Jalón et al. (2022) investigated mindful, empathic and pro-environmental attitudes in 10-12-year old elementary students. The MBI was delivered in 5-min practice sessions three times per week over a course of four months, by the homeroom teacher who had experience with meditation. Compared with the passive control

group ( $n = 25$ ), the MBI group ( $n = 25$ ) improved significantly, with large effects on mindfulness skills and pro-environmental attitudes and with medium effects on considerate social style and cognitive empathy. In conclusion, almost all concepts have been addressed as outcomes for mindfulness interventions in other studies. So far, this has not been combined in a single study, that has included the concept of connectedness to nature.

### **3 Summary of the State of Research**

The scientific research field of mindfulness in general and, in particular, of mindfulness in the education system is of growing interest. With initial research mainly in adulthood, there is now an increased focus on the efficacy and positive effects of MBIs in childhood and adolescence. Since most of the mindfulness research to date has been conducted in the USA, the focus of this work is on mindfulness in preschool and elementary school settings in the German education system.

The term mindfulness has its origin in Buddhism. There are differences between Buddhist scholars and Western scientists regarding the definition of the term. In the scientific context, Kabat-Zinn's working definitions of mindfulness are mostly cited. Also, the two component model of Bishop et al. (2004) is often mentioned.

As questions were raised regarding a more comprehensive theoretical framework, theoretical frameworks such as the four interacting components and the associated brain regions by Hölzel, Lazar, et al. (2011) emerged. In response to the demand in the scientific community to make the concept measurable (Goodman et al., 2017), several self-reported questionnaires were developed, later also for children and adolescents.

There are many reasons for the early use of mindfulness-based programs with children and adolescents. However, differences in implementation compared to adults are important to note. Up to date, there are studies regarding different mindfulness-based programs and some meta-analyses and reviews in the preschool and elementary school setting. The most relevant

work for this study has been described in more detail. During the literature search, it was noticed that more programs and reviews in elementary school settings exist. Overall, a large heterogeneity of the studies regarding e.g., sample size, length of intervention, program type, and trainer experience with mindfulness is noticeable. For that reason, there are differences between studies in terms of how different concepts are measured and consequently regarding the results or effectiveness of MBIs. However, overall MBIs in preschool and elementary settings seem to have positive effects on EFs (Jansen et al., 2016; Janz et al., 2019), emotion regulation (Crescentini et al., 2016; Roemer et al., 2015; Vickery & Dorjee, 2016), and other concepts. With the following two studies we want to provide further insights, which effects MBIs in preschool and elementary schools may promote and which concepts they may influence.

## **4 First Study: A Kind Mind: Enhancing Socio-Emotional Skills in German Preschool Children Through the Mindfulness-Based Kindness Curriculum<sup>1</sup>**

### **4.1 Goals and Hypotheses**

While mindfulness in adults is scientifically already quite well studied and positive effects are recognized, childhood studies, especially of young children, call for wider professional awareness (Weare, 2013). Following the approach of Flook et al. (2015), conducting their study in a Midwestern city in the USA, we wanted to investigate effects of the mindfulness-based KC in a German-speaking area, where we would expect similar positive results from a mindfulness training. We chose this program because it has already been scientifically evaluated, has very detailed instructions and is well tailored to the age of preschoolers. The goal of the present study was to gain insights on the effects of an MBI on

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<sup>1</sup> The results presented in this chapter are currently under review:  
Portele, C., Siebertz, M., & Jansen, P. (2023). A kind mind: Enhancing socio-emotional skills in German preschool children through the mindfulness-based Kindness Curriculum. *Mindfulness*.



EFs and socio-emotional competencies in preschool children. To our best knowledge, no mindfulness study exists with a German sample in an early educational setting.

Hypothesis 1) according to the findings of Flook et al. (2015), we assume that children participating in the mindfulness group would experience an increase in emotional competencies such as emotion knowledge, emotion regulation, empathy, prosocial behavior and delay of gratification compared to the control group.

Hypothesis 2) we wanted to investigate if the mindfulness group in comparison to the wait-list control group shows improvements in cognitive abilities, especially in the dimensions of inhibition measured using the Flanker and Go-No Go task. According to the study of Thierry et al. (2016) an improvement can be expected, while according to Flook et al. (2015) no such improvement might be likely.

## **4.2 Methods**

### **4.2.1 Participants**

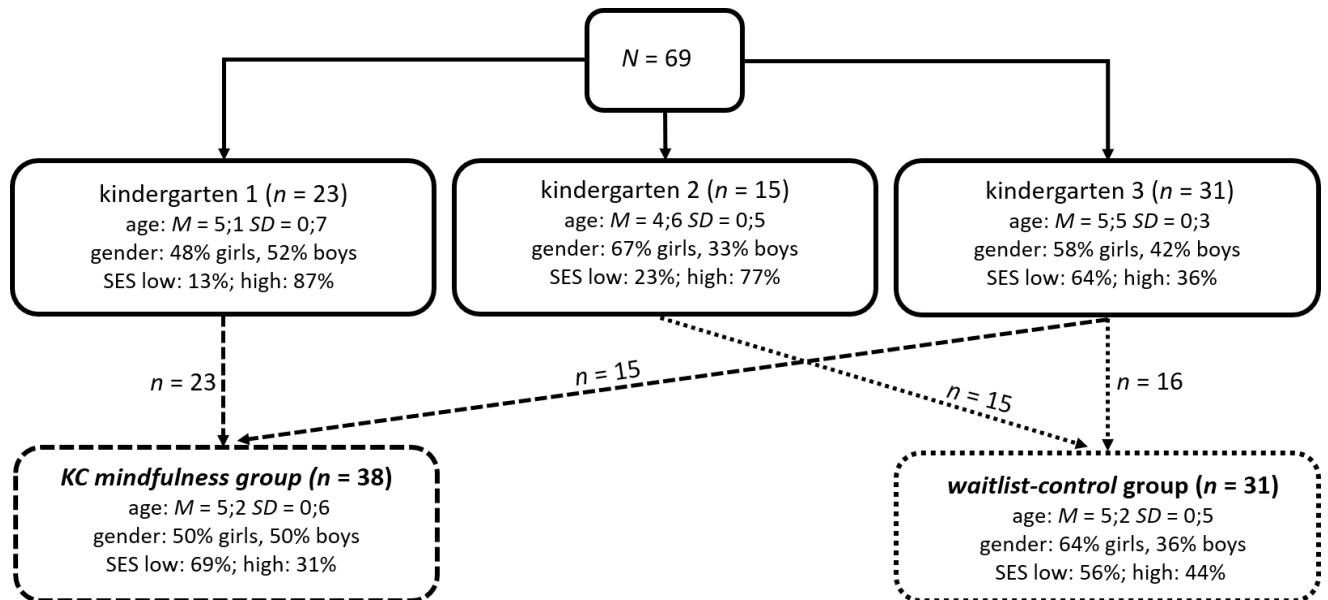
Following Flook et al. (2015), a sample size of at least 68 children was aimed at for participation. Accordingly, with a large effect size  $f = .40$ , an alpha-level of  $p = .05$ , and a power of  $1 - \beta = .80$ , a power analysis with G\*power (Faul et al., 2007) for the ANCOVA resulted in  $N = 52$  to detect significant effects. To emphasize the practical relevance, a large effect size was chosen. The total sample consisted of 72 children. Three children were excluded from data analysis, leading to 69 participants ( $M$  age = 5;3 (year; month),  $SD = 0;8$ , age range: 3;11 to 6;4) included in the analysis. One child was sick at posttesting and the other two had serious language and comprehension problems which were reflected in a deviation of the reaction time response rates by  $\pm 2 SD$ . Preschool children were recruited from three state kindergartens in a city with about 150.000 inhabitants in the southeast of Germany. Two kindergartens were situated near the local university and the university hospital. In contrast, the third one was an integrative kindergarten in a socially weaker area of the city, meaning that most children came

from families with a migration background and restricted living conditions. Several kindergarteners were asked about their participation. These three kindergartens were chosen because they were immediately willing to participate in the project. If, from their parents, children were allowed to participate, we had no further inclusion or exclusion criteria. All three kindergartens open from 7 am to at least 5 pm; have a morning circle routine and lunch together. To our knowledge, the teachers had no specific socio-emotional training background. One kindergarten had an open classroom system, whereas two kindergartens had fixed existing classes.

Due to the field-character of the study and following Flook et al. (2015), children were randomly assigned as existing classes or as new groups (depending on the number of children of the appropriate age per classroom and the classroom organization of the kindergarten) to conditions to the mindfulness-based KC ( $n = 38$ ; 19 girls and 19 boys;  $M$  age = 5;3,  $SD = 0;8$ ) and to the wait-list control group ( $n = 31$ ; 20 girls and 11 boys;  $M$  age = 5;3,  $SD = 0;7$ ). Since Kindergarten 3 was a larger kindergarten, several classrooms participated in the project, so that one part could be assigned to the intervention group and one part to the control group. Attendance in the mindfulness program was on average  $M = 13.63$  ( $SD = 1.81$ ) of 16 hours total which corresponds to an attendance rate of 85%. Figure 1 provides an overview of the participating kindergartens, the SES, age, and gender for the KC and control group. The index for the SES was formed following Jöckel et al. (1998). Each of the participants' parents were assigned a value between 1 and 8 according to their formal educational level. Higher values indicate a higher SES. Each participant's SES corresponded to the higher of the two values from the parents. To make the statistical models more interpretable the SES was dichotomized into values below 7 and values equal to or greater than 7. The latter represents academic education.

**Figure 1**

*Flowchart of participants from the three kindergartens including group size, age, gender, and SES details*



#### 4.2.2 Mindfulness-based Kindness Curriculum (KC)

We implemented the mindfulness-based KC (Flook et al., 2015), which can be received by the following link (<https://centerhealthyminds.org/join-the-movement/sign-up-to-receive-the-kindness-curriculum>). The KC was especially designed for preschoolers by Healthy Minds Innovations, Inc. (2017). The topics incorporate mindful body awareness, feelings in general, problem solving, gratitude and caring for all living things and the world. Children's literature, as well as music and movement, are integrated to make the concepts more accessible to preschoolers. At all times, the current needs of the children were given priority over a scheduled delivery of the lessons. The original complete KC consists of two 20-30 min lessons each week for 12 weeks; overall 24 lessons. As described in the instructions, the KC may be adapted to the needs and situations of one's own project. Therefore, due to organizational reasons (e.g., to complete part of the study before winter vacations and because we were only allowed to go into the kindergarten for a shorter period of time due to the uncertainties of the pandemic

development) regarding the feasibility of implementation of the KC in the kindergarten, we shortened the time of duration to eight weeks. While the eight topics remained the same, we consolidated the three lessons per topic into two lessons each, which resulted in slightly longer sessions than in the original KC. Typical recurring exercises like the ‘growing friendship wish’, the ‘caring song’ etc. were retained. Thus, the MBI in this study consisted of two 30-45-minute lessons each week over eight weeks for 16 lessons in total. A detailed overview is given in Table 1. The lessons were team-taught by an external person, a researcher experienced with mindfulness, and a student assistant studying mindfulness; both experienced in working with children. In consultation and cooperation with the Center for Healthy Minds with the goal of broadening the use of the curriculum also in the German-speaking area, the entire curriculum was translated into German. Songs, books, and music were adapted to the German context (Portele & Jansen, 2021). The German version *Achtsame Herzlichkeit im Kindergarten. Kindern helfen, emotionale Intelligenz und Resilienz zu entwickeln* was published by arbor Verlag.

**Table 1**

*Overview of the shortened version of the KC used in the present study*

Topic1-8	Lessons 1-16
Topic 1: Mindful bodies and planting seeds of kindness	Lesson 1 Mindful bodies and awareness of attention and breath Lesson 2 Growing seeds and friendship with kindness
Topic 2: I feel emotions on the inside	Lesson 3 Quiet emotions on the inside Lesson 4 Different emotions feel differently on the inside
Topic 3: How I feel on the inside shows on the outside	Lesson 5 Emotions on the inside show on the outside Lesson 6 Working with emotions in a kind and friendly way
Topic 4: Taking care of strong emotions on the inside and outside	Lesson 7 Busy mind, clear, mind jars and practicing them Lesson 8 What else can we do when we are upset?

Topic 5: Calming and working out problems	Lesson 9 Mindful movement Lesson 10 Forgiving myself and others
Topic 6: Gratitude	Lesson 11 Gratitude for people or things in my life Lesson 12 Gratitude for my body
Topic 7: All people depend on each other and the world	Lesson 13 People around the world want peace and connections to others Lesson 14 Caring for animals and insects
Topic 8: Gratitude, caring for our world and wrap-up	Lesson 15 Gratitude and caring or our world Lesson 16 Bringing it all together and wrap-up

### 4.2.3 Measures

#### 4.2.3.1 Inventory for the Assessment of Emotional Competencies in Three- to Six-Year Old Children [Inventar zur Erfassung emotionaler Kompetenzen bei Drei- bis Sechsjährigen; EMK 3-6]

To measure the improvements in socio-emotional competencies (Hypothesis 1), we chose the EMK 3-6 (Petermann & Gust, 2016), a German inventory, for this specific age group. It consists of a child-friendly individual test, used in our study, and pedagogical employees' external assessment. The EMK 3-6 measures components of emotion knowledge, emotion regulation, and empathy by administering five sub-tests for *primary emotions* (19 items), *secondary emotions* (14 items), *prosocial behavior* (21 items), *empathy* (15 items), and *delay of gratification*. The *primary* and *secondary emotions*, and *prosocial behavior* tasks were conducted with a stimulus book showing photos of children's faces or short scenes. In addition to naming and recognizing emotions, mimic markers, and causes of emotions, strategies for regulating emotions should be enumerated. For *primary emotions* (joy, sadness, fear, and anger) and *secondary emotions* (pride, guilt, and shame), the child should, for example, point to the correct picture presenting the requested emotion or find solution options (e.g., What could help the child not to be sad anymore?). The child is presented with seven short scenes displayed as photos to investigate prosocial behavior. Subsequently, the child is asked to respond to the

scene, express prosocial behavior, identify a prosocial solution from three alternatives, and justify it. In the *empathy* subtest to test cognitive and emotional empathy, four stories with a gendered wooden figure are played by the investigator. This task involves the child taking the perspective of the wooden figures, “Anna or Paul”, same age as the tested child, and answering questions from their point of view. During the *delay of gratification*, a typical scenario was acted out for the child to respond appropriately (e.g., While I have yet to enter anything here, please wait until then and do not touch the gift). Effective, neutral, and ineffective waiting strategies were ticked.

The experimenter sat at a 45-degree angle facing the child. The child’s answers for all five subtests were written down on a log sheet. The entire implementation lasted max. 30 minutes. The investigators were not blinded to condition, but the evaluation was executed in a blinded manner by a non-involved person. In the test manual (Petermann & Gust, 2016), internal consistency was, in summary, good, with a Cronbach’s alpha across the subscales between .78 (empathy) and .90 (prosocial behavior). For the subtest *delay of gratification*, retest reliability between 25 and 37 days correlated highly and ranged from  $r_{tt} = .75$  to .82.

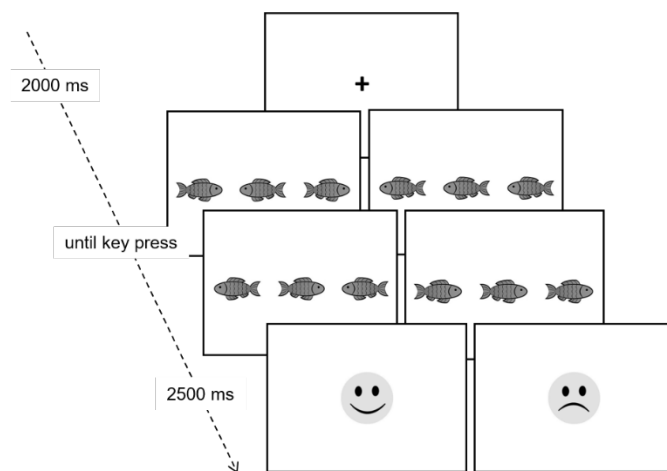
#### **4.2.3.2 Test of Executive Functions: Flanker Task**

To measure the improvements in EFs (Hypothesis 2), the Flanker and Go-No Go Tasks were chosen. The Flanker task (B. A. Eriksen & Eriksen, 1974) is a well-tested way to make inhibition measurable with letters or arrows as stimuli for adults (C. W. Eriksen, 1995). As shown in the work of Zelazo et al. (2013) fish proved to be meaningful stimuli for the Flanker task with children. The child sat in front of a 15-inch laptop on a children’s chair. At the beginning of the experiment, a black fixation cross was presented for 2000 ms. Throughout the experiment, the background color of the screen was white. Subsequently, one of the four following conditions appeared randomized until a key press occurred: Two congruent conditions where all three bluish fish are facing right or left and two incongruent conditions where the fish in the center is facing right or left and the two flanked fish are facing in the

opposite directions. The children should react as quickly as possible and press the right or left arrow key depending on whether the fish in the middle is pointing to the right or left side. Figure 2 shows a visual representation of the experimental setting. In the incongruent conditions, reaction times are expected to be longer due to distraction by the two flanked fishes. The task consisted of 40 trials in total, 10 trials per condition. After a correct keystroke a yellow happy smiley and after an incorrect keystroke a sad smiley was presented for 2500 ms. In the instruction it was emphasized that even after a sad smiley the child should just continue. The next stimulus occurred without a fixation cross in each case. To indicate the end of the test, a smiley face was shown, and the experimenter commended the child. The duration of the implementation of this computer-based test was about 10-15 min.

**Figure 2**

*Timeline of trials in the Flanker task*



*Note.* The four fish pictures show the two congruent and two incongruent conditions. The feedback smileys were shown depending on whether the key press was correct or incorrect.

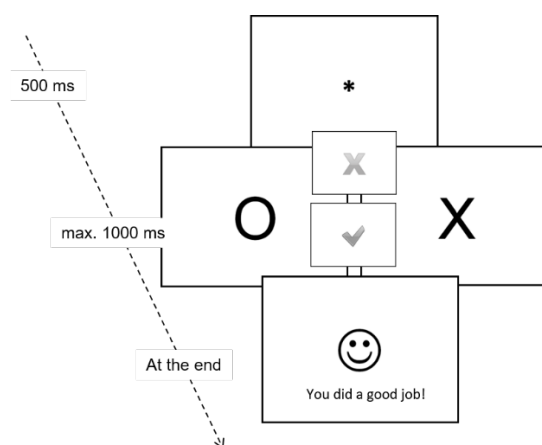
#### 4.2.3.3 Test of Executive Functions: Go-No Go Task.

Another test to measure inhibition is the Go-No Go task (Drewe, 1975). In the middle of the screen a black fixation star on a white screen was presented for 500 ms followed by either a black cross (Go) or a circle (No Go). The child should react as fast as possible with a touchpad

press when a cross occurred. Every stimulus was shown either until the touchpad was pressed or for max. 1000 ms in case of no response. As soon as the child responded, a blank screen appeared for 1000 ms. Every trial started with the presentation of the fixation star. In order to become familiar with the speed of the presented stimuli, there was a warm-up phase with 15 trials (8 crosses, 7 circles). After each practice trial, feedback was given from the program, a green check for a correct and a red cross for an incorrect reaction presented for 1500 ms. During the warm-up phase motivation or correction was provided by the investigator. There was no feedback afterwards during the regular trials. A visual representation of the test procedure is depicted in Figure 3. There was a total of 100 trials (70 crosses, 30 circles). The child was always offered a break after 10 trials if necessary. The next round was started by pressing a button. At the end of the experiment, a smiley was shown and "You did a good job!" was read out by the experimenter, and the child was complemented.

**Figure 3**

*Timeline of trials in the Go-No Go task*



*Note.* The tick and the cross show the feedback presented only in the warm-up phase. The smiley was presented at the end of the experiment.



#### **4.2.4 Procedure**

The eight-week mindfulness intervention was embedded in two weeks pre- and posttesting for both the intervention and wait-list control group. For an effective use of time, pretesting started first for the intervention group. Afterwards, this group already received the first mindfulness lessons, while the wait-list control group participated in the pretest. Each child was tested individually. To ensure a variety between computerized and paper and pencil tests, the test sequence was as follows: 1) Flanker task, 2) EMK 3-6, and 3) Go-No Go task. Depending on the child, overall testing lasted from 45 minutes to one hour.

For the Flanker task, as well as for the Go-No Go task instructions were given orally by the experimenter. To improve commitment and attention during testing, the Flanker and Go-No Go tasks were embedded in a cover story appropriate for children. As hunger and eating resonate well with children at this young age (Wardle et al., 2001), children were asked to feed a very hungry fish flanked by two others using the two arrow keys. In the Go-No Go task the children were instructed to accumulate food for the hungry fish from the Flanker task gathering all x's. The hungry fish eats x very gladly, whereas it gets stomach-ache from the o. The children could take refreshment or other breaks after each of the completed ten rounds of the Go-No Go, and during the EMK, if necessary. During the Flanker task, which only lasted ten minutes, no break was possible. Additionally, after each completed test, children got a smiley in their personal treasure map that was given to them to enhance motivation throughout testing before the experiment. Upon completion of all tests, children were rewarded with candy. It was important that children felt comfortable and safe. In general, the children's commitment was quite good; none of them wanted to quit the testing situation. After the mindfulness training, posttesting was conducted placing the intervention group before the wait-list control group. Where feasible, care was taken to ensure a similar time interval at pre- and posttesting for each subject. Implementation in the third kindergarten coincided with the COVID-19 pandemic. During posttesting, the hygiene regulations required masks. Transparent facial masks that did

not restrict facial expression were used to ensure comparability with the circumstances during pretesting without masks. We could finish the study before more challenging disruptions like home schooling etc. were required.

#### 4.2.5 *Data Analyses*

In the data preparation, trials with reaction times below a certain cut-off value were first excluded. These were lower reaction times than 200 ms in the Flanker task and lower reaction times than 100 ms in the Go-No Go task, due to the latter being easier. Furthermore, trials with reaction times 2 *SD* above or below a subject's mean reaction time were omitted in the Flanker and the Go-No Go task following recommendations by Baayen and Milin (2010). Participants were excluded from individual analyses for the Flanker and Go-No Go tasks when they showed values 1.5 times the interquartile range above or below the sample median, following Richter et al. (2016). Participants were also excluded from analyses if they answered correctly on less than half of the trials in the Flanker task or in less than 20 trials in the Go-No Go task. For the Flanker task this was applied per condition. Exclusion reasons are stated in the results section for each analysis, separately for each participant. Error trials and hits following an error were sorted out for the Flanker task because only here feedback was presented after each trial.

Before further calculations, we conducted one-way analyses of variance (ANOVAs) to determine differences between the groups in age and SES and used a  $\chi^2$  test to detect gender differences. Hence, we assessed postscore differences between the mindfulness and control groups using ANCOVAs (Miller & Chapman, 2001) with the postscores as dependent variables. ANCOVAs were performed for the Flanker effect on reaction times and hit rates (difference incongruent – congruent conditions), reaction times, hit rate and false alarm rate of the Go-No Go task and the EMK subscale sum scores *primary emotion*, *secondary emotion*, *prosocial behavior*, and *empathy*. Planned covariates were the prescore of the respective measure, age in months, gender and SES. Acknowledging the vivid discussion on suitable statistical procedures

for controlled pre-post designs we chose this method with the following rationale: In a simulation study, O'Connell et al. (2017) compared typical analysis procedures for controlled pre-post designs. They found the ANCOVA approach – under proper randomization and therefore equal prescores – to produce an unbiased estimation of the treatment effect and to be the most effective in terms of precision and statistical power. In our study participants could not be randomly assigned to treatment and control conditions individually but as existing groups within kindergartens. Hence, we compared the covariates between treatment and control groups and excluded a covariate from a model if they differed. Likewise, covariates were excluded if they violated the assumption of regression slope homogeneity. For the subtest *delay of gratification* of the EMK 3-6 we calculated a Mann-Whitney-U-Test to determine if there are group differences in the pre- and posttest according to the coded strategies used (ineffective, neutral, effective). The significance level for all analyses was set to 5%.

### 4.3 Results

One-way ANOVAs showed no significant difference between mindfulness and the control group regarding age,  $F(1, 70) = .021, p = .885, \eta_p^2 = .000$ , and SES,  $F(1, 61) = 2.13, p = .150, \eta_p^2 = .034$ . The  $\chi^2$  test showed that the ratio of boys and girls did not differ between groups,  $\chi^2(1) = 1.46, p = .226, \phi = 1.46$ . Due to no differences in the pretest, age, gender, and SES were not considered in the following statistical analyses.

#### 4.3.1 EMK 3-6

The three generally excluded children described in the section participants were as well excluded for further EMK 3-6 analyses. Table 2 illustrates the ANCOVA results for the EMK-Questionnaire. The sub-scales *primary emotions* and *prosocial behavior* differed significantly at posttest between groups accounting for the covariates. The intervention group showed higher values than the control group. Prescores significantly predicted postscores in both models. Accounting for the covariates, *secondary emotions* were higher in the intervention group as

well, but the model showed low goodness-of-fit and prescores had to be excluded from the model due to significant differences between groups at pretest. *Empathy* did not differ significantly between groups at posttest but was predicted by prescores. Last, there was no statistically significant difference in the *delay of gratification* between mindfulness and control group before and after the mindfulness intervention, all  $p > .406$ .

**Table 2**

*ANCOVA models predicting the EMK-subscales through group assignment with covariates prescore, age, gender, and SES. Marginal means of groups are estimated at the means of the covariates*

Dependent Variable	Predictors	$F(df_{\text{eff}}, df_{\text{err}})$	$p$	$\eta^2_{\text{part}}$	EMM [95% CI]	
					Control	Mindfulness
EMK PE						
	Group	6.738 (1,55)	.012	.109	23.65 [21.62, 25.69]	27.16 [25.48, 28.84]
	Prescore	8.236 (1,55)	.006	.130		
	Age	0.983 (1,55)	.326	.018		
	Gender	4.834 (1,55)	.032	.081		
	SES	0.358 (1,55)	.552	.006		
						$R^2_{\text{adj}} = .257$
EMK SE						
	Group	4.522 (1,56)	.038	.075	11.02 [9.25, 12.80]	13.51 [12.05, 14.98]
	Age	0.830 (1,56)	.366	.015		
	Gender	1.096 (1,56)	.300	.019		
	SES	0.049 (1,56)	.826	.001		
						$R^2_{\text{adj}} = .026$
EMK PB						
	Group	4.280 (1,55)	.043	.072	21.06 [20.01, 22.11]	22.51 [21.65, 23.38]
	Prescore	28.560 (1,55)	<.001	.342		
	Age	0.298 (1,55)	.587	.005		
	Gender	0.031 (1,55)	.862	.001		
	SES	0.879 (1,55)	.353	.016		
						$R^2_{\text{adj}} = .419$
EMK EMP						
	Group	3.196 (1,55)	.079	.055	16.47 [15.37, 17.58]	17.78 [16.87, 18.69]
	Prescore	7.411 (1,55)	.009	.119		
	Age	3.781 (1,55)	.057	.064		
	Gender	1.734 (1,55)	.193	.031		
	SES	0.221 (1,55)	.640	.004		
						$R^2_{\text{adj}} = .244$

*Note.* PE: primary emotions, SE: secondary emotion, PB: prosocial behavior, EMP: empathy,

EMM: estimated marginal mean.

### 4.3.2 *Flanker Task*

ANCOVA results for the Flanker task outcomes are shown in Table 3. For the analysis of the Flanker effect on reaction times, four participants had to be excluded. Three met the general exclusion criteria mentioned above because of illness at posttesting and serious language and comprehension problems and one child had too low reaction times which was reflected in a deviation of the reaction time response rates by  $\pm 2$  *SD*. Beyond that, some participants met one or more of the flanker-specific exclusion criteria. For each analysis we report the number of excluded participants for each criterion separately and how many participants are excluded considering all criteria. Thirteen participants were excluded because they answered incorrectly more than half of the time in one of the conditions, six because they showed extreme values in postscores, and seven because they showed extreme scores in prescores. Overall, seven participants from the control group and 14 participants from the mindfulness group were excluded. For the analysis of the Flanker effect on hit rates, the same applied except no participants showed extreme values. Hence, six controls and nine participants from the mindfulness group were excluded. The negative adjusted R-squared indicates that the model predicting reaction time performs worse than a model including only the intercept, meaning a bad goodness-of-fit. Accounting for the covariates, the Flanker effect in reaction times does not differ significantly between groups. For the Flanker effect on hit rates, homogeneity of regression slopes from prescores on postscores was violated between groups. This was indicated by a significant interaction effect between prescore and group on postscores in a multiple regression during assumption checks. Prescore was dropped as a covariate from the model. The remaining model showed low goodness-of-fit and no significant difference between groups accounting for the covariates.

**Table 3**

*ANCOVA models predicting outcome measures in the Flanker task through group assignment with covariates prescore, age, gender, and SES. Marginal means of groups are estimated at the means of the covariates*

Dependent Variable	Predictors	EMM [95% CI]				
		$F(df_{eff}, df_{err})$	$p$	$\eta^2_{part}$	Control	Mindfulness
RT	Group	0.113 (1,38)	.738	.003	116 ms [46, 187]	133 ms [69, 197]
	Prescore	0.113 (1,38)	.746	.003		
	Age	0.379 (1,38)	.542	.010		
	Gender	0.237 (1,38)	.629	.006		
	SES	1.459 (1,38)	.235	.037		$R^2_{adj} = -.069$
HR	Group	2.251 (1,56)	.139	.039	.013 [-.025, .051]	.051 [.019, .082]
	Age	0.827 (1,56)	.367	.015		
	Gender	0.243 (1,56)	.624	.004		
	SES	2.606 (1,56)	.112	.044		$R^2_{adj} = .049$

*Note.* RT: reaction time, HR: hit rate, EMM: estimated marginal mean.

### 4.3.3 Go-No Go Task

Due to technical problems with the laptop, five children were unable to complete the Go-No Go task. Out of the total 100 trials, less than 60 were recorded. Additionally, twelve participants made too many errors, and one participant showed extreme values in the pretest reaction times. For reaction times, five controls and nine participants from the mindfulness group were excluded. For hit rates, four participants showed extreme prescores, leading to five participants being excluded from the control and eight from the mindfulness group. For false alarm rates, two participants showed extreme postscores and three extreme prescores. Here, six controls and eleven from the mindfulness group were excluded overall. None of the three outcome measures in the Go-No Go task – reaction times, hit and false alarm rates – differed significantly between groups at posttest when accounting for the covariates as shown by the

ANCOVA results in Table 4. However, all three measures were strongly predicted by pretest performance.

**Table 4**

*ANCOVA models predicting outcome measures in the Go-No Go task through group assignment with covariates prescore, age, gender, and SES. Marginal means of groups are estimated at the means of the covariates*

Dependent Variable	Predictors	$F(df_{\text{eff}}, df_{\text{err}})$	$p$	$\eta^2_{\text{part}}$	EMM [95% CI]	
					Control	Mindfulness
RT	Group	0.145 (1,44)	.705	.003	701 ms [659, 743]	690 ms [653, 727]
	Prescore	11.761 (1,44)	.001	.211		
	Age	1.672 (1,44)	.203	.037		
	Gender	1.007 (1,44)	.321	.022		
	SES	0.001 (1,44)	.973	<.001		
						$R^2_{\text{adj}} = .257$
HR	Group	1.613 (1,45)	.211	.035	.73 [.66, .80]	.79 [.73, .85]
	Prescore	11.635 (1,45)	.001	.205		
	Age	0.010 (1,45)	.921	<.001		
	Gender	<0.001 (1,45)	.993	<.001		
	SES	0.641 (1,45)	.428	.014		
						$R^2_{\text{adj}} = .163$
FAR	Group	1.416 (1,41)	.241	.033	.16 [.12, .19]	.13 [.09, .16]
	Prescore	13.845 (1,41)	.001	.252		
	Age	1.043 (1,41)	.313	.025		
	Gender	1.905 (1,41)	.175	.044		
	SES	0.343 (1,41)	.561	.008		
						$R^2_{\text{adj}} = .261$

*Note.* RT: reaction time, HR: hit rate, FAR: false alarm rate, EMM: estimated marginal mean.

#### 4.4 Discussion

According to the model of Hölzel, Lazar, et al. (2011), emotion regulation and perspective changes were improved: The children participating in the mindfulness group showed better *primary, secondary emotions*, and *prosocial behavior* compared with the control group (see Hypothesis 1). The children of the mindfulness group enhanced in recognizing basic and more difficult emotions, and in finding prosocial solutions. Regarding Hypothesis 2, the

mindfulness group showed no better performance concerning EFs (inhibition) than the control group. Most children in the intervention group were eager not to miss any session. Because the attendance rate was high at 85% and only three children missed the posttest, this study supports a good practicability of the KC in a German kindergarten setting.

#### ***4.4.1 Placement of Results in Current State of Research***

##### **4.4.1.1 Mindfulness and the Socio-Emotional Development**

According to the study of Flook et al. (2015), emotional development and prosocial behavior could be improved after eight weeks of intervention. Because the KC emphasizes emotional processes (e.g., topic 2 “feeling emotions on the inside”, topic 4 “taking care of strong emotions on the inside and outside”), it seemed apparent that emotional processes were enhanced. The results are also in line with a recent pilot study demonstrating that a MBI improves socio-emotional learning skills in 21 preschoolers in Italy (Berti & Cigala, 2022). However, the improvement of the KC group for empathy compared to the control group did not reach significance, which is astonishing because low to moderate relations were found between empathy and pro-sociality (Eisenberg & Miller, 1987). Also, a study with 5-6 years old children showed that empathic concern was the primary influence on prosocial behavior (Williams et al., 2014). In the *delay of gratification*, the two groups did not differ in the strategies used to wait for a reward. However, this result is in line with the results of Flook et al. (2015). The ability to delay gratification may instead be assigned to EFs (O'Toole et al., 2018) as suppression of an impulse rather than emotional and social competencies. It is in line with the results of the current study that no differences were found in EFs (inhibition) before and after the mindfulness intervention.



#### **4.4.1.2 Mindfulness and the Development of Executive Functions**

There was no better performance in the mindfulness group compared to the waiting control-group. This is in line with the study of Flook et al. (2015). In their study, both groups showed improvement in the Flanker task, with a larger effect size for the control group. It contradicts the studies of Thierry et al. (2016). However, Thierry et al. (2016) did not use a computerized Flanker task for measuring inhibition but a normative assessment of executive functioning, the *Behavior Rating Inventory of Executive Function – Preschool Version* (BRIEF-P; Gioia et al., 2002). This gives a hint that the type of measure must be regarded carefully when investigating inhibition. It has been demonstrated that the BRIEF-scales are rarely correlated with cognitive tests measuring EFs (e.g., Bodnar et al., 2007). The results of Schonert-Reichl et al. (2015) showed that children at the 4<sup>th</sup> and 5<sup>th</sup> grade showed faster reaction times in the Flanker task after the MindUP program compared with a control group receiving a social responsibility program. Both programs were taught for 12 weeks for 40-50 minutes once a week. However, it seemed to be difficult to compare both studies due to the distinct mindfulness programs, the different types of control groups and the age of the children.

#### **4.4.2 Limitations and Outlook for Following Studies**

First of all, given the number of exclusions from several of the data analyses, and the small sample size, these exclusions make it difficult to interpret the findings and therefore the conclusions. Especially in the preschool setting, it is not easy to get large samples, because at this young age parents are often rather critical towards study projects. In the Go-No Go task, technical problems occurred with the laptop, and in the Flanker task, some records had to be excluded. One reason for this could be the young age of the children. Their attention slips away more easily, or they have more problems to stay motivated during the whole test than adults.

If feasible, in terms of staffing for future studies, it would be experimentally preferable if the mindfulness trainers did not conduct the testing, but rather other blinded to condition non-involved individuals.

Jalón et al. (2022) recommend an passive and active control group (e.g., with relaxation techniques or mindful movement or yoga) to increase internal validity. Accordingly, an exaggeration of the beneficial effects of mindfulness compared to a passive control group receiving the business as usual could be presumed (Butterfield & Roberts, 2022).

The baseline and posttests on EF and socio-emotional competencies were first given to the treatment group and then to the control group. Children had to our knowledge no possibility to talk to each other about the test contents due to the different groups and no mixing of groups because of the pandemic and because of the three different kindergartens. Every child was tested in the same separate classroom. We assume that no differences are to be expected from the order of testing, because so to least there has been an equal distance in time for both groups. If the order for the posttesting had been changed, there would have been a larger time difference between groups.

It can be seen as a limitation of the study that part of the project coincided with the COVID-19 pandemic. However, we assume that since the children already knew the instructors, part of the posttesting with transparent face masks should have no influence on the results. Of course, anxiety or other changes may have developed in the children because of, for example, the lockdown, which could have affected the study results. Nevertheless, we tend to assume positive effects from a mindfulness intervention, also with hygiene rules that also determined every-day kindergarten life (Yuan, 2021). Thus, children could benefit and receive good support from a mindfulness program especially in times of a pandemic, when many things seem to be more uncertain. In further research it would be desirable to include the preschool educators in the intervention to establish a mindful climate in the kindergarten in the long term. Due to

the good practical feasibility of the mindfulness project, further projects could be planned in other areas of the education system, such as in elementary or secondary schools.

#### ***4.4.3 Future Directions***

For a larger scale project to study change in children through mindfulness, a project similar to the ReSource project could be planned (Singer & Engert, 2019). In this 9-month project three facets of mindfulness were enlightened: present-moment attention and interoception, socio-emotional processes such as compassion and loving kindness and meta-cognitive processes and perspective-taking on self and others. In such a project with children, the individual aspects, and facets under the umbrella term of mindfulness and meditation could be investigated in an even more differentiated manner. In addition, objective measures such as biopsychological markers (e.g., cortisol and alpha amylase) or measurements with fMRI or EEG could provide further insight into changes in bodily stress reactions and specific brain regions. It is expected that a mindfulness program for children which focuses especially on the present-moment attention and interoception would improve attentional competencies in children as for example measured with the Flanker task. Mindfulness studies with young children are hard to conduct, but both, the Flook et al. (2015) and our study (Portele et al., 2023) provide promising evidence that mindfulness interventions may be beneficial for developmental processes. However, the construct validity of mindfulness (see van Dam et al., 2018) has to be regarded in studies with children.

Another point to discuss is the question whether the intervention "worked" for improving socio-emotional skills due to the mindfulness component or due to the lessons specifically teaching socio-emotional competencies. Specifically, do mindfulness programs need to include the socio-emotional content to be effective in this regard or is the practice of mindfulness sufficient? There exist for example some programs to especially promote emotion self-regulation in preschool children (Bradley et al., 2012). In this study the efficacy of the

Early HeartSmarts (EHS) was assessed. By learning emotion self-regulation, key age-appropriate socioemotional competencies to facilitate emotional, social, and cognitive development are part of the training. Overall, children of the EHS group showed significant better results in development measures than children of the control group. The KC used in the current study is mindfulness-based but has as well contents of socioemotional learning.

Following the approach of the three stages of being mindful, teaching mindfully, and teaching mindfulness (Hawkins & Burke, 2021), we conclude that mindful interaction with children also already contributes to a change in classroom atmosphere. One study demonstrated an improvement of the elementary classroom climate with higher levels of classroom cohesion after a brief 2-min MBI delivered three times per day over 10 weeks (Meyer & Eklund, 2020). This finding supports a better learning atmosphere through mindful activities in the classroom. The teacher could stay more with him- or herself, can distinguish his own emotional state from those in the classroom, is more present, listens more actively, which all positively effects the interaction and the interrelationship with the children.

#### ***4.4.4 Implications for Practice***

This research program investigated an evaluation of a specific curriculum in authentic settings. Therefore, affecting practice and another argument for establishing mindfulness lessons in kindergarten is the children's visible joy and personal development. This progress could be seen from lesson to lesson, even not registered with the help of interviews. Over time, the children, for example, were able to access and share nice stories they had experienced much more quickly, so that more seeds of kindness could be planted in the kindness garden poster. The kindness garden poster includes earth, plants, sun, and clouds with rain. Beyond that, plants need caring and love to thrive. And so, with each good story of the children, another seed of kindness could be planted. These are changes that cannot necessarily be measured objectively but are still important to mention. The fact that such changes can already be seen after eight

weeks indicates a promising intervention. Of paramount importance in the subject of teaching mindfulness is the issue of voluntariness. If possible, all children should receive a basic training in mindfulness to get to know the topic in an unbiased way. Nevertheless, participation beyond this should always remain voluntarily, depending on the individual state of the day.

Focus on socio-emotional development is important for every society. Thus, the study can be seen as a critical step toward supporting an educational policy that is aware of the necessity of explicit, scientifically sound social-emotional education in early education. However, this study is essential for another reason: In today's educational climate, educational policymakers are focused on learning, teaching, and cognitive development and do not enough appreciate the importance of socio-emotional development which is evident to most of the preschool teachers.

#### **4.4.5 Conclusion**

In conclusion, this study once more adds the influence of mindfulness-based programs in German early childhood settings. However, much more research is needed. In particular, the significant improvements in the socio-emotional domain call for further research to investigate the reasons for these improvements. It could be determined whether the improvements are primarily based on differences concerning the content of the various MBIs or whether children at this age are peculiarly responsive to socio-emotional development and support. The diversity of MBIs is often listed as a point of criticism in the research field of mindfulness. However, it may also be seen as an opportunity to find the right program for a particular target group. Attention-focused meditation practices might be necessary for children with attentional problems, whereas a heartfulness focus might be more valuable for children with emotional problems like anxiety. However, the most crucial point might be that teachers and children are motivated to participate in such a program.

## **5 Second Study: The Effects of a Mindfulness-Based Training in an Elementary School in Germany<sup>2</sup>**

### **5.1 Goals and Hypotheses**

After the significant results regarding the socio-emotional components in the first study, we now wanted to elicit other possible components that can be improved by mindfulness. In addition, we divided the socio-emotional component into a social and emotional one. Therefore, in the second study, we aimed to identify the effect of a mindfulness training on elementary school-aged children and to examine the different mechanisms through which mindfulness functions (Hölzel, Lazar, et al., 2011). To satisfy the requirement of the current state of research to investigate mindfulness with its subfacets and the targeted effects of the components of mindfulness, we aimed to find tests for each target component (bodily, cognitive, emotional, and social) of the program and added the global concept of connectedness to nature. In an explorative manner, we established a mindfulness-plus group, to investigate whether a higher amount of practice positively supports the effects of the training. We hypothesized that, compared with a control group, the mindfulness-plus and the mindfulness group would improve more in the domains of emotion regulation, resources, attentional processes, bodily based processes, and connectedness to nature. Finally, we hypothesized that the mindfulness-plus group performs better than the mindfulness group on the five measured outcomes.

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<sup>2</sup> The results presented in this chapter were published in advance in: Portele, C., & Jansen, P. (2023). The effects of a mindfulness-based training in an elementary school in Germany. *Mindfulness*.

## 5.2 Methods

### 5.2.1 Participants

We conducted a power analysis with G\*Power (Faul et al., 2007) and, assuming a value between a low and medium effect size  $d = 0.175$ , an alpha level of  $p = .05$ , and a power of  $1 - \beta = 0.8$ , a sample size of 84 was calculated. Ninety-three children were recruited from three third grade and three fourth grade classes of a state elementary school with an external site in a city in southeast Germany. Two children were not allowed to further participate in the study after their parents were asked to complete the socioeconomic status questionnaire. Therefore, the final sample size was 91 ( $M$  age = 9.74 years,  $SD = 0.76$ , range: 8–11). The six school classes were assigned to three different groups (mindfulness-plus, mindfulness, and control). Children in the mindfulness-plus group ( $n = 32$ ; 18 girls and 14 boys;  $M$  age = 9.72 years,  $SD = 0.89$ ) received the mindfulness training, and the teachers repeated a mindfulness exercise with them each day in school. The teachers of the two allocated classes had experience with mindfulness and therefore were directly assigned to the mindfulness-plus condition. The other two conditions were randomly assigned to the classrooms. In the mindfulness group ( $n = 31$ ; 19 girls and 12 boys;  $M$  age = 9.55 years,  $SD = 0.81$ ) children participated in the mindfulness training, and the control group ( $n = 28$ ; 17 girls and 11 boys;  $M$  age = 9.96 years,  $SD = 0.43$ ) had the standard school routine. At the end of the project, the control group received a sample session to experience mindfulness exercises.

In accordance with Lampert et al. (2018), the socioeconomic status (SES) index was generated as a household characteristic on the basis of parental information on the three scales: Education, occupation, and income. For each scale, points between 1 and 7 were assigned so that the total score varied between 3 and 21 points. The responses of the parent with higher values were used to calculate the total SES. Higher total scores indicate a higher SES. Some respondents generally do not provide information on their income situation (Riphahn &

Serfling, 2005). In this study, 40 SES questionnaires were completed, 17 SES questionnaires were not filled out, and 34 parents did not specify the amount of income. These data were thus imputed from education and occupation data and income values from other parents who had the same or similar education and occupation scores.

## **5.2.2 Intervention**

### **5.2.2.1 Mindfulness Lessons Adapted From The Mindful Education Workbook (Rechtschaffen, 2016, 2018)**

In this school project the mindfulness lessons were adapted from the Mindful Education Workbook (Rechtschaffen, 2016, 2018). Rechtschaffen (2016) built his lessons according to different realms and emphasized that mindfulness skills develop best through progressive stages. The exercises are assigned to the five literacies: (a) physical, (b) mental, (c) emotional, (d) social, and (e) global literacy. *Physical literacy* is about the language of the body, being present and regulated in one's own body. The *mental literacy* deals with mechanics of the mind, witnessing thought patterns and developing focusing skills. The basis for the *emotional literacy* includes regulating difficult emotions and enhancing good feelings. The next step, the *social literacy*, brings the learned skills into social dynamics, communicating compassionately and listening deeply. The *global literacy* is about interconnectedness with everything in the world. Teaching children mindfulness in a fun way, quasi – 'playing mindfulness' is one of the main foci of the program. Breathing exercises where breathing patterns are combined with animal or nature movements, popcorn thoughts (one half of the class always raises the hand when a thought occurs, the other half tries to count the number of thoughts), heartfelt phrases (sort of loving kindness mediation), rose and thorn (one child tells about a good story that happened to him (rose) and then about a not so good story (thorn)), another child listens deeply and sums up the rose and thorn stories; subsequently, narrator and listener roles are changed), and life cycle assessment represent one sample exercise for each literacy. For each of the five literacies we



tried to find a suitable measurement method (see description under 5.2.3 Measures). There were two lessons per literacy, so the children participated in a total of 10 mindfulness lessons, twice per week, 45 min each. Another 11th lesson was used as integration, review, recap, and time for favorite exercises. For an overview see Table 5. The lessons were team-taught by an external MBSR teacher experienced in elementary education and trained by Daniel Rechtschaffen as Mindful Education Teacher Trainer together with an assistant, trained in mindfulness with children.

**Table 5**

*Overview of the lessons based on the mindful education workbook (Rechtschaffen, 2016)*

The five realms of mindful literacy	Lessons 1-11
Physical literacy	Lesson 1 Exploring the language of the body Lesson 2 Moving and exploring the breath
Mental literacy	Lesson 3 Throwing an anchor – breathing and listening Lesson 4 Throwing an anchor – seeing and thinking
Emotional literacy	Lesson 5 Being happy and making happy Lesson 6 Stressful feelings and their roots
Social literacy	Lesson 7 Inner and outer weather report and nonverbal communication Lesson 8 Mindful communication
Global literacy	Lesson 9 Mindful eating and knowing your world Lesson 10 Integration practices
	Additional Lesson 11 Repetition and favorite exercises

### **5.2.3 Measures**

#### **5.2.3.1 Physical Self-Concept Questionnaire for Primary School-Aged Children (PSK-K; Dreiskämper et al., 2015)**

The physical self-concept questionnaire for elementary school-aged children [Fragebogen zur Erfassung des physischen Selbstkonzepts von Kindern im Grundschulalter] (PSK-K; Dreiskämper et al., 2015) was used. Dreiskämper et al. (2015) developed the PSK-K explicitly for children based on the questionnaire for the measurement of the physical self-concept (PSK; Stiller et al., 2004), which is the German translation of the Physical Self-Description Questionnaire (PSDQ; Marsh et al., 1994). The PSK-K contains 21 items in total, consisting of seven scales (endurance, flexibility, strength, coordination, speed, global sport competence, and physical appearance). Each scale has three associated questions and a 4-point scale response format that ranges from 1 (not at all) to 4 (absolutely). Higher total scores indicate a more positive level of self-concept. The internal consistency of the seven scales in the test manual (Cronbach's  $\alpha$ ) ranges between .57 and .82. The internal consistency of the seven scales in our study varied between .61 and .87 for both Cronbach's  $\alpha$  and McDonald's  $\omega$ .

#### **5.2.3.2 Flanker Task (B. A. Eriksen & Eriksen, 1974)**

Analogue to the first study, inhibitory control, one of the three main components of EFs, was measured with the Flanker task (B. A. Eriksen & Eriksen, 1974) to assess the realm *mental literacy*. For a detailed description and a figure of the experimental setting see 4.2.3.2 Test of Executive Functions: Flanker Task.

#### **5.2.3.3 Questionnaire for the Assessment of Emotion Regulation in Children and Adolescents (FEEL-KJ; Grob & Smolenski, 2005)**

To assess emotional processes, the questionnaire for the assessment of emotion regulation in children and adolescents [Fragebogen zur Erhebung der Emotionsregulation bei Kindern und Jugendlichen] (FEEL-KJ; Grob & Smolenski, 2005) was applied. This instrument measures multidimensional and emotion-specific emotion regulation strategies for the three

emotions of anger, fear, and sadness. We looked at seven adaptive strategies (problem-focused action, distraction, mood elevation, accepting, forgetting, cognitive problem solving, and reevaluating), with 42 items; five maladaptive strategies (giving up, aggressive behavior, withdrawal, self-deprecation, and perseverance), with 30 items; and three other strategies that could not be assigned to any of the other two secondary scales (expression, social support, and emotion control), with 18 items. There are two items for each of the 15 strategy options and each of the three emotions, resulting in 90 items in total (Goldschmidt & Berth, 2006). The answer format consists of a 5-point scale that ranges from 1 (almost never) to 5 (almost always). The tests internal consistency was described as satisfactory in the test manual, with a Cronbach's  $\alpha$  across emotions between .69 (giving up, forgetting, and perseverance) and .91 (social support). In the present study the internal consistencies in the pretest were very good (Cronbach's  $\alpha = .94$ , McDonald's  $\omega = .93$ , for 41 items) for the adaptive strategies, with good reliabilities for each of the adaptive strategies for anger (Cronbach's  $\alpha = .85$ , McDonald's  $\omega = .85$ ), fear (Cronbach's  $\alpha = .85$ , McDonald's  $\omega = .84$ ), and sadness (Cronbach's  $\alpha = .88$ , McDonald's  $\omega = .88$ ). The internal consistency for the maladaptive strategies was satisfactory, (Cronbach's  $\alpha = .81$ , McDonald's  $\omega = .76$ ). The internal consistencies for the three other strategies were satisfactory for expression (Cronbach's  $\alpha = .71$ , McDonald's  $\omega = .65$ ) and good for social support (Cronbach's  $\alpha = .81$ , McDonald's  $\omega = .81$ ) but not for emotion control (Cronbach's  $\alpha = .61$ , McDonald's  $\omega = .59$ ).

#### **5.2.3.4 Questionnaire on Resources in Childhood and Adolescence (FRKJ 8-16; Lohaus & Nussbeck, 2016)**

The questionnaire that addressed resources in childhood and adolescence [Fragebogen zu Ressourcen im Kindes- und Jugendalter] (FRKJ 8-16; Lohaus & Nussbeck, 2016) was conducted in the realm of social abilities. The FRKJ 8-16 can be used to measure developmental resources in children who have been distinguished in regard to available personal development and environmental resources. Empathy and perspective-taking skills, self-efficacy, self-esteem,

a sense of coherence, optimism, and self-control are the constructs measured for personal development resources. For the environmental resources, parental support, authoritative parenting style, peer group integration, and school integration are the measured constructs. The answer format consists of a four-point scale that ranges from 1 (never true) to 4 (always true). Each questionnaire scale consists of six items, resulting in 60 items. One item is reverse coded. A high numerical score indicates a high resource level. Cronbach's  $\alpha$  for the internal consistency for the ten scales in the test manual varies between .69 and .89 and, in our study, between .63 and .89 (Cronbach's  $\alpha$ ) and between .62 and .89 (McDonald's  $\omega$ ).

### **5.2.3.5 Questionnaire on Connectedness to Nature (Otto & Pensini, 2017)**

To measure *global literacy*, the questionnaire on connectedness to nature (Otto & Pensini, 2017), a 20-item shortened version of the Disposition to Connect to Nature scale (DCN; Brügger et al., 2011), was utilized. The scale is suitable for children. The response format is a five-point scale ranging from 1 (not at all) to 5 (absolutely). "I feel the need to be out in nature" and "Watching animals is exciting" represent exemplarily two items of the scale. Two items are reverse coded. A total score is formed from all 20 items: the higher the total score, the higher the connectedness to nature. The scales are based on a Rasch model.

### **5.2.4 Procedure**

The six-week mindfulness intervention was embedded in one week of pre- and one week of posttesting. The mindfulness lessons were conducted twice per week for one school hour (45 min) in the home classrooms of the two mindfulness-plus and the two mindfulness groups. Both groups received handouts for each lesson with exercises and small tasks to voluntarily complete at home. Only in the mindfulness-plus groups, mindfulness exercises were repeated daily in class with the class teachers who had personal meditation experiences. In the two mindfulness-plus groups the training was conducted in a circle of chairs; in all other groups, the children sat at their school desks.

The four questionnaires (FEEL-KJ, FRKJ 8-16, PSK-K and connectedness to nature) were administered in a group testing format in class with the teacher. Before the start of the first test, the teacher read an instruction explaining that there are no right and wrong answers and that answers should be given as spontaneously as possible. Occurring questions about terminology and rating scales were answered according to the recommendations in the test manuals. The individual tests were performed at time intervals to avoid fatigue effects.

The Flanker task took place in a one-to-one setting with a transparent partition between the experimenter and the child for COVID-19 infection control reasons. In addition to the written instructions on the computer, oral instructions were given uniformly. A cover story for children was used to improve attention and commitment during testing: Using the two arrow keys, they were asked to feed a hungry fish in the middle that was flanked by two others. Upon completion of the task, candy was given as a reward. Because of the COVID-19 pandemic, hygiene, and infection protection measures, such as face masks, regular ventilation, and so on, were implemented depending on the current number of infections and the requirements of the school.

### **5.2.5 Data Analyses**

In the data preparation, trials in the Flanker task with reaction times lower than a cut-off value of 200 ms were first omitted. Following recommendations of Baayen and Milin (2010), trials with reaction times 2 *SD* below or above a subject's mean reaction time were also excluded. Because of the given feedback after each trial, error trials and hits after an error were sorted out for the reaction times. Following Richter et al. (2016), participants with reaction time values 1.5 times the interquartile range above or below the sample median were excluded from individual analyses for the Flanker task. This was done separately for the congruent and incongruent condition and for the pre- and posttest. For posttest data outliers were defined for each group individually because of possible group differences after the mindfulness

intervention. Further exclusion reasons or missing data, e.g., if participants were not present at posttesting, are stated in the results section for each test.

According to the instructions of the test manual of the FEEL-KJ, if an item response was missing, the mean value was calculated from the available 5 out of 6 answers and rounded in an integer. For the FRKJ 8-16, it was also recommended that if only one item was missing, the arithmetic mean of the remaining five responses on the scale should be substituted.

Before further calculations, one-way ANOVAs were assessed to calculate whether the three groups differed in age and SES and a  $\chi^2$  test were used to detect possible differences for gender. Then, repeated-measures ANOVAs were performed with the total scores of the FEEL-KJ, FRKJ 8-16, PSK-K and connectedness to nature questionnaire, the subscale scores of the FEEL-KJ and the FRKJ 8-16, and reaction times and hit rates in the Flanker task as dependent variables. The time of measurement (pre, post) served as within-subject factor, the three groups (mindfulness-plus, mindfulness, control) as between-subject factor. For the Flanker task another within-subject factor condition (congruent, incongruent) was added for a three-way analysis. If interaction effects were significant, paired *t*-Tests were computed. The significance level for all analyses was set to  $p = .05$ . If there was a significant effect of the factor group, two separate analyses of variance were calculated for the posttest scores. In this case, the significance level for all analyses was Bonferroni-corrected and set to  $p = .025$ .

### 5.3 Results

One-way ANOVAs showed that there was no significant difference between the three groups (mindfulness-plus, mindfulness, control) regarding age,  $F(2, 88) = 2.29, p = .107, \eta_p^2 = .050$ , and SES,  $F(2, 71) = 0.22, p = .804, \eta_p^2 = .006$ . Because 17 parents had not completed the SES questionnaire, as described above, the sample size for the SES calculations was  $N = 74$  (mindfulness-plus:  $n = 27$ , mindfulness:  $n = 26$ , control:  $n = 21$ ). The  $\chi^2$  test showed that the number of boys and girls did not differ between groups,  $\chi^2(2) = .197, p = .906, \phi = .047$ . Due

to missing pretest differences, age, gender, and SES were not considered in the following statistical analyses.

### 5.3.1 *Physical Literacy (PSK-K)*

Here, the sample was  $N = 90$  because one child in the control group did not have posttesting results. The repeated-measures ANOVA for the difference in the overall PSK-K score between the groups after the intervention revealed a significant effect of time,  $F(1, 87) = 10.57, p = .002, \eta_p^2 = .108$ , a non-significant effect of group,  $F(2, 87) = 0.31, p = .732, \eta_p^2 = .007$ , and a non-significant time x group interaction,  $F(2, 87) = 0.57, p = .567, \eta_p^2 = .013$ .

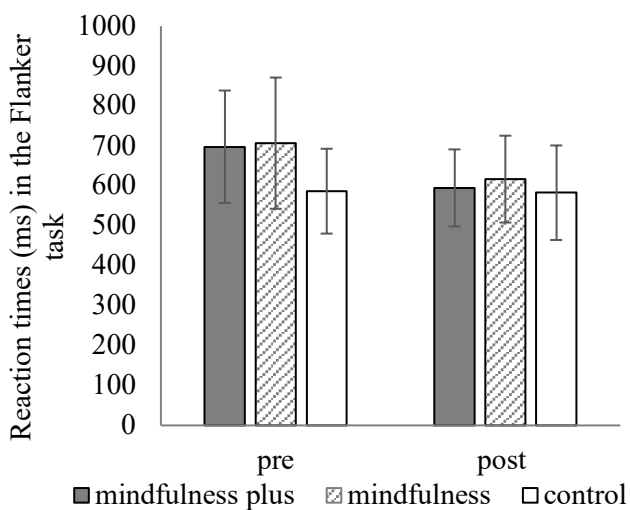
### 5.3.2 *Mental Literacy (Flanker Task)*

After the exclusion of outliers  $N = 75$  datasets remained (mindfulness-plus:  $n = 27$ , mindfulness:  $n = 25$ , control:  $n = 23$ ) for the following analyses. Regarding reaction time, there was a significant main effect of time,  $F(1, 72) = 38.48, p < .001, \eta_p^2 = .348$ , showing a shorter reaction time in the posttest ( $M = 598.64, SD = 107.16$ ) compared to the pretest ( $M = 667.00, SD = 148.29$ ). Also, a main effect of condition revealed significance,  $F(1, 72) = 16.75, p < .001, \eta_p^2 = .189$ , confirming the Flanker effect with shorter reaction times for the congruent ( $M = 623.85, SD = 117.25$ ) compared to the incongruent ( $M = 641.79, SD = 124.39$ ) items. The main effect of group did not reach significance,  $F(2, 72) = 2.93, p = .060, \eta_p^2 = .075$ . Furthermore, there were two significant interactions, one between time x group,  $F(2, 72) = 8.37, p < .001, \eta_p^2 = .189$ , the second one between condition x group,  $F(2, 72) = 3.23, p < .045, \eta_p^2 = .082$ . For the first interaction, paired-samples  $t$ -tests were further calculated to examine differences in the reaction times within each group in the pre- and posttest. In the mindfulness-plus group the reaction times improved significantly from pre- to posttest,  $t(26) = 5.67, p < .001$ . In the mindfulness group as well the reaction times improved significantly from pre- to posttest,  $t(24) = 4.25, p < .001$ . But in the control group the reaction times did not differ

significantly from pre- to posttest,  $t(22) = 0.27$ ,  $p = .786$ . Figure 4 shows a graphical representation of the means and standard deviations.

#### Figure 4

*Means (SD) of the reaction times in milliseconds (ms) in the Flanker task comparing pre- to posttest in mindfulness-plus, mindfulness and control group*



For the second interaction between condition x group, the mindfulness-plus group was not significantly faster,  $t(26) = -1.08$ ,  $p = .290$ , in the congruent ( $M = 642.87$ ,  $SD = 114.76$ ) compared to the incongruent condition ( $M = 650.22$ ,  $SD = 110.14$ ). Whereas the mindfulness group was significantly faster,  $t(24) = -3.98$ ,  $p < .001$ , in the congruent ( $M = 645.36$ ,  $SD = 122.31$ ) compared to the incongruent condition ( $M = 678.76$ ,  $SD = 138.48$ ). The control group was not significantly faster,  $t(22) = -1.75$ ,  $p = .094$ , in the congruent ( $M = 578.14$ ,  $SD = 105.85$ ) compared to the incongruent condition ( $M = 591.71$ ,  $SD = 111.93$ ). The interaction effect of time x condition did not reach significance,  $F(1, 72) = 3.69$ ,  $p = .059$ ,  $\eta_p^2 = .049$ . The three-way interaction between time, condition and group was not statistically significant,  $F(2, 72) = .733$ ,  $p = .484$ ,  $\eta_p^2 = .020$ .

Secondly, the main and all possible interaction effects of group, time, and condition in the repeated-measures ANOVA for the hit rate were not statistically significant (all  $p > .051$ ).



### 5.3.3 Emotional Literacy (FEEL-KJ)

For the total score of the strategies and some subscales, the sample was  $N = 90$  because one child in the mindfulness group had not completed more than one item in each strategy and thus, the mean could not be substituted. Repeated-measures ANOVA results with all main and interaction effects for the adaptive strategies of the FEEL-KJ are shown in Table 6 for a better overview. The last column shows the differences (Bonferroni-corrected t-tests) between the groups in the posttests.

**Table 6**

*Repeated-measures ANOVAs for differences between the three groups (mindfulness-plus (M+), mindfulness (M) and control group (CG)) in the adaptive strategies in total, for anger, fear and sadness and for the seven adaptive strategies subscales each of the FEEL-KJ*

Dependent Variable	Main and interaction effects	$n$	$F(df_{\text{eff}}, df_{\text{err}})$	$p$	$\eta_p^2$	Differences between M+, M and CG
<b>FEEL-KJ – AD-S</b>						
Total		90				
	Effect of time		0.21 (1,87)	.649	.002	
	Effect of group		3.02 (2,87)	.054	.065	M+ > CG; M > CG
	Time x group		2.33 (2,87)	<.05	.129	
<i>ANG</i>		90				
	Effect of time		0.03 (1,87)	.867	.000	
	Effect of group		2.90 (2,87)	.063	.062	M+ > CG; M > CG
	Time x group		4.20 (2,87)	<.05	.125	
<i>FEA</i>		90				
	Effect of time		0.46 (1,87)	.502	.005	
	Effect of group		3.20 (2,87)	<.05	.068	M+ > CG; M > CG
	Time x group		0.24 (2,87)	<.05	.088	
<i>SAD</i>		90				
	Effect of time		0.11 (1,87)	.738	.001	
	Effect of group		2.21 (2,87)	.115	.048	M > CG;
	Time x group		3.22 (2,87)	<.05	.069	M+ = CG; M+ = M
<i>PFA</i>		91				
	Effect of time		0.52 (1,88)	.474	.006	
	Effect of group		3.28 (2,88)	<.05	.069	M+ > CG; M > CG
	Time x group		6.84 (2,88)	<.05	.135	
<i>DIS</i>		90				
	Effect of time		0.68 (1,87)	.411	.008	

ME	Effect of group	2.10 (2,87)	.128	.046	-
	Time x group	0.54 (2,87)	.584	.012	
	90				
AC	Effect of time	0.87 (1,87)	.353	.010	
	Effect of group	1.40 (2,87)	.253	.031	M+ > CG;
	Time x group	6.15 (2,87)	<.05	.124	M = CG; M+ = M
FO	Effect of time	0.76 (1,88)	.386	.009	
	Effect of group	0.57 (2,88)	.570	.013	-
	Time x group	2.70 (2,88)	.073	.058	
CPS	Effect of time	1.81 (1,88)	.182	.020	
	Effect of group	2.13 (2,88)	.125	.046	M > CG;
	Time x group	4.93 (2,88)	<.05	.101	M+ = CG; M+ = M
RE	Effect of time	0.23 (1,88)	.636	.003	
	Effect of group	4.67 (2,88)	<.05	.096	-
	Time x group	0.91 (2,88)	.406	.020	
RE	Effect of time	3.14 (1,87)	.080	.035	
	Effect of group	4.93 (2,87)	<.05	.102	M > CG;
	Time x group	3.44 (2,87)	<.05	.073	M+ = CG; M+ = M

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*Note.* **AD-S** = adaptive strategies; *ANG* = anger; *FEA* = fear; *SAD* = sadness; *PFA* = problem-focused action; *DIS* = distraction; *ME* = mood elevation; *AC* = accepting; *FO* = forgetting; *CPS* = cognitive problem solving; *RE* = reevaluating

All means and standard deviations for the variables with a significant interaction effect of group x time for every of the three groups in pre- and posttesting are listed in Table 7. In the following section only the significant effects and corresponding post-hoc analyses are presented in detail.

**Table 7**

*Pre- and posttest means and standard deviations for significant variables of the FEEL-KJ*

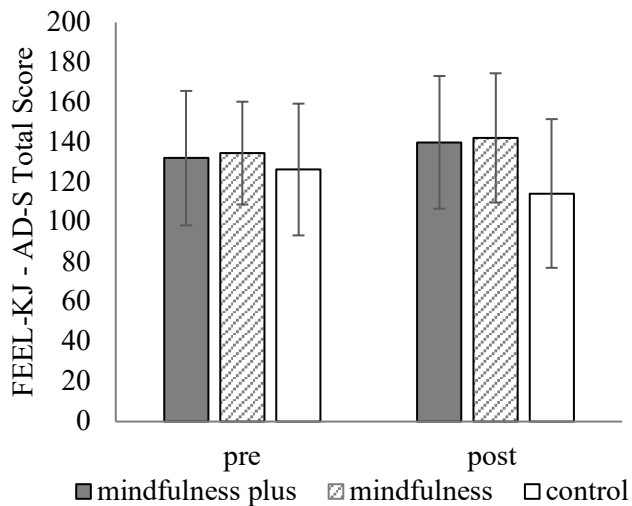
Dependent variable	control		mindfulness		mindfulness-plus	
	pre <i>M (SD)</i>	post <i>M (SD)</i>	pre <i>M (SD)</i>	post <i>M (SD)</i>	pre <i>M (SD)</i>	post <i>M (SD)</i>
<b>FEEL-KJ – AD-S</b>						
Total	126.29 (33.01)	114.29 (37.26)	134.53 (25.75)	142.13 (32.38)	132.00 (33.67)	139.91 (33.24)
<i>FEA</i>	41.68 (13.00)	38.18 (14.07)	44.70 (10.24)	47.70 (11.86)	45.13 (11.16)	47.66 (11.89)
<i>ANG</i>	42.11 (11.55)	37.00 (12.86)	45.37 (9.02)	46.20 (12.11)	42.72 (12.22)	46.47 (11.48)
<i>SAD</i>	42.50 (13.04)	39.14 (12.28)	45.20 (9.43)	48.07 (11.02)	44.16 (12.72)	45.69 (12.11)
PFA	17.82 (6.06)	15.68 (5.89)	19.06 (5.44)	20.29 (5.95)	19.03 (5.75)	20.97 (5.71)
RE	13.04 (4.57)	13.04 (4.57)	18.13 (5.31)	18.13 (5.31)	14.28 (4.74)	15.97 (5.88)
ME	20.86 (7.31)	17.57 (7.76)	21.23 (5.36)	21.57 (6.12)	20.97 (6.91)	22.34 (6.43)
FO	19.32 (4.81)	16.36 (5.72)	20.13 (4.73)	20.35 (4.82)	18.22 (5.63)	18.91 (5.47)

*Note.* **AD-S** = adaptive strategies; *FEA* = fear; *ANG* = anger; *SAD* = sadness; PFA = problem-focused action; RE = reevaluating; ME = mood elevation; FO = forgetting

For the adaptive strategies in total, there was a statistically significant interaction effect of group x time ( $p < .05$ ). There was no difference in the pretest between groups,  $F(2, 88) = .54, p = .586, \eta_p^2 = .012$ , but in the posttest,  $F(2, 87) = 5.89, p = .004, \eta_p^2 = .119$ . Bonferroni-corrected post-hoc tests showed significant higher values (all  $p < .015$ ) in the mindfulness and the mindfulness-plus group compared to the control group. Between mindfulness-plus and mindfulness group there was no statistically significant difference ( $p = 1.000$ ). A graphical representation of the results for the adaptive strategies in total is provided in Figure 5.

**Figure 5**

*Means (SD) of the total score of the adaptive strategies of the FEEL-KJ in the pre- and posttest for mindfulness-plus, mindfulness and control group*



*Note.* AD-S = adaptive strategies

Regarding the adaptive strategies for the emotion fear, the main effect of group and the interaction effect of time x group revealed significance (all  $p < .05$ ). In the pretest there was no difference between groups,  $F(2, 88) = .75, p = .477, \eta_p^2 = .017$ , but in the posttest,  $F(2, 87) = 5.49, p = .006, \eta_p^2 = .112$ . Bonferroni-adjusted post-hoc analysis revealed significant higher scores (all  $p < .015$ ) in the mindfulness and mindfulness-plus group compared to the control group. Mindfulness-plus and mindfulness group were not significantly different ( $p = 1.000$ ). For the emotions anger and sadness, the interaction effect of group x time was significant (all  $p < .05$ ). For anger, there was no difference in the pretest between groups,  $F(2, 88) = .78, p = .462, \eta_p^2 = .017$ , but in the posttest,  $F(2, 87) = 5.72, p = .005, \eta_p^2 = .116$ . Bonferroni-corrected post-hoc tests showed that the mindfulness-plus and the mindfulness group showed significant higher values (all  $p < .015$ ) compared to the control group. Between the two mindfulness groups there was no statistically significant difference ( $p = 1.000$ ). For sadness, there was no difference in the pretest between groups,  $F(2, 88) = .41, p = .667, \eta_p^2 = .009$ , but in the posttest,  $F(2, 87)$

= 4.39,  $p = .015$ ,  $\eta_p^2 = .092$ . Bonferroni-adjusted post-hoc tests showed significant higher values ( $p < .016$ ) in the mindfulness group compared to the control group. Mindfulness-plus and control group ( $p = .106$ ) as well as mindfulness-plus and mindfulness group ( $p = 1.000$ ) did not differ significantly.

The subscales problem-focused action and reevaluating reached a significant main effect of group and interaction effect of time x group (all  $p < .05$ ). For problem-focused action, there was no difference in the pretest between groups,  $F(2, 88) = .44$ ,  $p = .644$ ,  $\eta_p^2 = .010$ , but in the posttest,  $F(2, 88) = 7.07$ ,  $p = .001$ ,  $\eta_p^2 = .138$ . Bonferroni-corrected post-hoc tests revealed significant higher values in the mindfulness-plus ( $p = .002$ ) and the mindfulness ( $p = .010$ ) group compared to the control group. The difference between the two mindfulness groups was statistically not significant ( $p = 1.000$ ). For reevaluating there was no difference in the pretest between groups,  $F(2, 88) = 1.62$ ,  $p = .205$ ,  $\eta_p^2 = .035$ , but in the posttest,  $F(2, 87) = 6.70$ ,  $p = .002$ ,  $\eta_p^2 = .133$ . Bonferroni-corrected post-hoc tests resulted in significant higher values ( $p < .001$ ) in the mindfulness group compared to the control group. Mindfulness-plus and control group ( $p = .107$ ) as well as mindfulness-plus and mindfulness group ( $p = .337$ ) did not differ significantly.

For the subscale mood elevation and forgetting the interaction effects were significant (all  $p < .05$ ). For mood elevation, there was no difference in the pretest between groups,  $F(2, 88) = .02$ ,  $p = .980$ ,  $\eta_p^2 = .000$ , but in the posttest,  $F(2, 87) = 4.16$ ,  $p = .019$ ,  $\eta_p^2 = .087$ . Bonferroni-corrected post-hoc tests yielded significant higher values ( $p = .024$ ) in the mindfulness-plus group compared to the control group. Mindfulness and control group ( $p = .082$ ) as well as mindfulness-plus and mindfulness group ( $p = 1.000$ ) did not differ in statistical significance. For forgetting, there was no difference in the pretest between groups,  $F(2, 88) = 1.12$ ,  $p = .331$ ,  $\eta_p^2 = .025$ , but in the posttest,  $F(2, 87) = 4.20$ ,  $p = .018$ ,  $\eta_p^2 = .087$ . Bonferroni-corrected post-hoc tests showed that the mindfulness group had significant higher values ( $p = .015$ ) compared to the control group. Mindfulness-plus and control group ( $p = .205$ ) as well as mindfulness-plus

and mindfulness group ( $p = .854$ ) did not differ significantly. The subscales distraction and accepting did not reach significance.

Repeated-measures ANOVA results with all main and interaction effects for the maladaptive strategies and other strategies are presented in Table 8 for a better overview. In the following section, only the significant interactions will be discussed in more detail. For the maladaptive strategies, there was a significant effect of time and an interaction effect of time x group for self-deprecation (all  $p < .05$ ). For self-deprecation there was no difference in the pretest between groups,  $F(2, 88) = .66, p = .522, \eta_p^2 = .015$  and in the posttest,  $F(2, 87) = 2.31, p = .105, \eta_p^2 = .050$ . Therefore, no post-hoc tests could be computed. For the total score of maladaptive strategies and the emotion sadness only the main effects of time were significant (all  $p < .05$ ). For the other strategies, the subscale social support had a significant effect of time ( $p < .05$ ) and interaction effect time x group ( $p < .001$ ). For social support there was no difference in the pretest between groups,  $F(2, 88) = 1.19, p = .522, \eta_p^2 = .308$  and in the posttest,  $F(2, 87) = 2.42, p = .095, \eta_p^2 = .053$ . Therefore, as well no post-hoc tests could be computed. All other subscales did not reach significance.

**Table 8**

*Repeated-measures ANOVAs for differences between the three groups (mindfulness-plus, mindfulness, control) in the maladaptive strategies in total, for anger, fear and sadness and for the five maladaptive strategies subscales each and three other strategies of the FEEL-KJ*

Dependent Variable	Main and interaction effects	<i>n</i>	<i>F</i> ( <i>df</i> <sub>eff</sub> , <i>df</i> <sub>err</sub> )	<i>p</i>	$\eta_p^2$
<b>FEEL-KJ – MAL-S</b>					
Total		90			
	Effect of time		4.64 (1,87)	<.05	.051
	Effect of group		0.01 (2,87)	.993	.000
	Time x group		1.68 (2,87)	.193	.037
<b>ANG</b>					
	Effect of time	90	1.48 (1,87)	.227	.017
	Effect of group		0.27 (2,87)	.767	.006
	Time x group		1.00 (2,87)	.372	.022

<i>FEA</i>		90			
	Effect of time		0.04 (1,87)	.836	.000
	Effect of group		0.15 (2,87)	.865	.003
	Time x group		0.57 (2,87)	.570	.013
<i>SAD</i>		90			
	Effect of time		9.14 (1,87)	<.05	.095
	Effect of group		0.02 (2,87)	.979	.000
	Time x group		1.75 (2,87)	.180	.039
<i>GIV</i>		91			
	Effect of time		2.49 (1,88)	.118	.028
	Effect of group		0.07 (2,88)	.937	.001
	Time x group		1.02 (2,88)	.366	.023
<i>AB</i>		90			
	Effect of time		3.80 (1,87)	.055	.042
	Effect of group		1.90 (2,87)	.156	.042
	Time x group		0.35 (2,87)	.705	.008
<i>WIT</i>		91			
	Effect of time		0.33 (1,88)	.565	.004
	Effect of group		0.23 (2,88)	.799	.005
	Time x group		0.20 (2,88)	.821	.004
<i>S-DE</i>		90			
	Effect of time		11.58 (1,87)	<.05	.118
	Effect of group		1.17 (2,87)	.316	.026
	Time x group		3.75 (2,87)	<.05	.079
<i>PER</i>		91			
	Effect of time		0.43 (1,88)	.512	.005
	Effect of group		0.11 (2,88)	.898	.002
	Time x group		1.62 (2,88)	.203	.036
<b>FEEL-KJ – OTH-S</b>					
<i>EXP</i>		91			
	Effect of time		0.00 (1,88)	.962	.000
	Effect of group		0.84 (2,88)	.436	.019
	Time x group		2.07 (2,88)	.133	.045
<i>SS</i>		90			
	Effect of time		4.10 (1,87)	<.05	.045
	Effect of group		0.07 (2,87)	.931	.002
	Time x group		9.28 (2,87)	<.001	.176
<i>EC</i>		90			
	Effect of time		0.24 (1,87)	.629	.003
	Effect of group		1.60 (2,87)	.208	.035
	Time x group		1.92 (2,87)	.153	.042

*Note.* **MAL-S** = maladaptive strategies; *ANG* = anger; *FEA* = fear; *SAD* = sadness; *GIV* = giving up; *AB* = aggressive behavior; *WIT* = withdrawal; *S-DE* = self-deprecation; *PER* = perseveration; **OTH-S** = other strategies; *EXP* = expression; *SS* = social support; *EC* = emotion control

### 5.3.4 Social Literacy (FRKJ 8-16)

The sample in the total score and for the subscales varied between  $N = 88$  and  $90$ . One child was missing at posttesting, and two others had too few questions completed in some subscales to form a score. Results for the repeated measure ANOVAs are listed in Table 9. Only the subscale parental support showed a significant main effect of group and interaction effect of time x group. There was a difference in the pretest between groups,  $F(2, 88) = 6.56, p = .002, \eta_p^2 = .130$ , and no difference in the posttest,  $F(2, 85) = 1.39, p = .254, \eta_p^2 = .032$ . Bonferroni-corrected post-hoc tests showed that in the pretest the control group ( $M = 22.62, SD = 2.04$ ) showed significant higher values compared to the mindfulness-plus group ( $M = 19.91, SD = 4.45; p = .010$ ) and the mindfulness group ( $M = 19.67, SD = 3.07; p = .004$ ). Mindfulness-plus and mindfulness group did not differ significantly ( $p = 1.000$ ). Some other subscales reached a significant main effect of time but no significant difference in terms of an increase in measured resources in favor of the mindfulness groups.

**Table 9**

*Repeated-measures ANOVAs for differences between the three groups (mindfulness-plus, mindfulness, control) in the total score and the ten subscales of the FRKJ 8-16*

Dependent Variable	Main and interaction effects	<i>n</i>	<i>F</i> ( <i>df</i> <sub>eff</sub> , <i>df</i> <sub>err</sub> )	<i>p</i>	$\eta_p^2$
FRKJ 8-16 – Total		88			
	Effect of time		6.93 (1,85)	<.05	.075
	Effect of group		0.08 (2,85)	.920	.002
EMP	Time x group	90	2.33 (2,85)	.104	.052
	Effect of time		8.29 (1,87)	<.05	.087
	Effect of group		0.04 (2,87)	.961	.001
S-EF	Time x group	90	1.54 (2,87)	.221	.034
	Effect of time		6.03 (1,87)	<.05	.065
	Effect of group		0.13 (2,87)	.875	.003
S-ES	Time x group	90	0.24 (2,87)	.784	.006
	Effect of time		0.75 (1,87)	.390	.009
	Effect of group		0.66 (2,87)	.521	.015
SOC	Time x group	90	3.08 (2,87)	.051	.066



	Effect of time		6.85 (1,87)	<.05	.073
	Effect of group		0.07 (2,87)	.937	.001
	Time x group		2.73 (2,87)	.071	.059
OPT		90			
	Effect of time		5.09 (1,87)	<.05	.055
	Effect of group		1.05 (2,87)	.354	.024
	Time x group		0.69 (2,87)	.503	.016
S-C		90			
	Effect of time		5.41 (1,87)	<.05	.059
	Effect of group		1.74 (2,87)	.182	.038
	Time x group		0.74 (2,87)	.479	.017
PS		88			
	Effect of time		0.20 (1,85)	.657	.002
	Effect of group		3.50 (2,85)	<.05	.076
	Time x group		4.89 (2,85)	<.05	.103
APS		88			
	Effect of time		2.81 (1,85)	.097	.032
	Effect of group		1.15 (2,85)	.322	.026
	Time x group		0.93 (2,85)	.400	.021
PGI		88			
	Effect of time		9.22 (1,85)	<.05	.098
	Effect of group		0.32 (2,85)	.729	.007
	Time x group		0.42 (2,85)	.659	.010
SI		88			
	Effect of time		0.05 (1,85)	.827	.001
	Effect of group		0.71 (2,85)	.497	.016
	Time x group		0.32 (2,85)	.730	.007

*Note.* EMP = empathy and perspective-talking skills; S-EF = self-efficacy; S-ES = self-esteem; SOC = sense of coherence; OPT = optimism; S-C = self-control; PS = parental support; APS = authoritative parenting style; PGI = peer group integration; SI = school integration

### 5.3.5 Global Literacy (Connectedness to Nature)

As with the PSK-K, the sample was  $N = 90$  because one child in the control group did not have posttesting results. Neither the effect of time,  $F(1, 87) = 2.80, p = .098, \eta_p^2 = .031$ , the effect of group,  $F(2, 87) = 1.99, p = .143, \eta_p^2 = .044$  nor the interaction time x group,  $F(2, 87) = 0.73, p = .486, \eta_p^2 = .016$  did reach significance.

## 5.4 Discussion

First, this study confirms a promising practical implementation and compatibility of an externally delivered MBI in an elementary school. A strength of this study is that we examined several concepts where a connection to mindfulness can be assumed. Our study could provide

evidence that mindfulness training in children effects emotional processes the most. However, in this sample there was little support for the other four concepts. Furthermore, it showed that the frequency of mindfulness exercises did not affect the outcome.

#### ***5.4.1 Placement of Results in Current State of Research***

##### **5.4.1.1 Mental Literacy**

The first hypothesis, that mindfulness-plus and mindfulness group would improve compared with the passive control group, could be partially confirmed in two of the five domains. Mindfulness-plus and mindfulness group differed significantly in reaction times from pre- to posttest, but not the control group. However, the result does not depend on the congruency of the stimuli, which means that the inhibition ability might not be enhanced after the mindfulness training but rather the processing speed in this cognitive task. For this, it might be interesting to investigate a possible positive influence of the mindfulness programs on other cognitive tasks to evaluate if the effect of a mindfulness training in school-aged children is a more global cognitive effect. The mindfulness group was significantly faster in the congruent compared to the incongruent condition after the MBI. Mindfulness-plus group and control group did not have significant faster reaction times. For the hit rate, no significant differences could be found. The hit rate in general was very high which could argue for a ceiling effect and that the task could possibly have been too easy for elementary school students. These findings are in accordance with the study of Richter et al. (2016) having found generally small error rates, as well. This repeated result could encourage the discussion of whether a Flanker task with five stimuli should be used in future studies with older elementary school children. However, even in the study of Janz et al. (2019) utilizing the Flanker task with five fish in a MBI (CalmSpace) for 6-year old elementary students no significant improvements could be found. In a new study on the role of EFs on children's experiences of mindfulness the authors suggest that EFs may also matter for non-significant outcomes in MBIs (Butterfield & Roberts,

2022). One reason for this could be that differences between intervention and control groups are reduced when subjects who show great difficulties in EFs participate. The authors consider that most research often gravitates toward presenting non-significant results without appreciating the significant benefits that might accrue for some participants. The duration of the MindfulMe! mindfulness training lasted six weeks and was conducted by external trainers, and hence is in line with our study in those two points (Butterfield & Roberts, 2022).

#### **5.4.1.2 Emotional Literacy**

For the FEEL-KJ measuring emotion regulation, most of the variables of the adaptive strategies revealed significance in favor to the mindfulness groups compared with the control group. Conforming to hypothesis 2 was only the result for the subscale mood elevation where the mindfulness-plus group had significantly higher scores than the control group. For the other subscales (adaptive strategies in total, fear, anger and sadness, problem-focused action, reevaluating, and forgetting), both mindfulness groups showed significantly higher scores than the control group, but the two mindfulness groups did not differ as hypothesized. The subscales distraction and accepting differed not significantly between groups after the MBI. There were no significant differences in maladaptive strategies in total and for the subscales, which can be logically explained in terms of content that a mindfulness intervention should not improve giving up, aggressive behavior, withdrawal, self-deprecation and perseveration. The three other strategies (expression, social support, and emotion control) also showed no significant difference between groups. Here, we can surmise whether the daily practice with the teachers had less effect than the lessons with the external mindfulness teachers after all. Perhaps a longer practice period per day would also be more meaningful. In this study, the teachers were free to decide which exercises were repeated, as long as they were done daily. Also, the children were allowed to guide the exercises which also worked out very well in the mindfulness lessons. For Rechtschaffen (2016) the emotional literacy relates especially to regulating difficult emotions and enhancing good feelings. The emotional literacy lessons focused on good wishes for self

and others, gratitude for what we already have every day in life, and what is easily overlooked, and doing good actions for others without the person immediately noticing it. In addition, the children learned some exercises on how to better learn to surf the emotional waves, and emergency exercises, like the vacuum cleaner breaths, for very strong, overwhelming feelings. Since a lot of emphasis is placed on a benevolent attitude in the implementation of a mindfulness intervention and the two trainers exemplified a very empathetic approach to the children, it could be that the emotional component was increasingly subject to all the hours of training and therefore laid more in focus.

In several studies, emotional and behavioral problems improved after MBIs (Joyce et al., 2010; Waldemar et al., 2016). The outcomes of the self-completion surveys and reflection by the teachers in the study of Joyce et al. (2010) indicated improvements in emotional health, in particular for children scoring in the *borderline* and *abnormal* categories prior to the program. In another study the students showed significant improvements in most areas of mental health (emotions, behavior, relationships, and prosocial behavior) and in quality of life scores (Waldemar et al., 2016).

#### **5.4.1.3 Physical, Social, and Global Literacy**

For the PSK-K no significant improvements for the two mindfulness groups could be shown. In the questionnaire FRKJ 8-16 for resources only the subscale parental support showed a significant interaction effect of time x group. However, there was only a significant difference in the pretest. In the pretest the children from the control group had higher values than both mindfulness groups. This could also be interpreted that the mindfulness group could have made up its shortfall through the intervention. For connectedness to nature no significant improvements for the two mindfulness groups could be shown.

For physical literacy, the PSK-K perhaps focuses too much on the athletic component and it would be better to use test measurements as e.g., the heartbeat perception task for interoception and self-perception in future studies. Some studies for example showed effects of

mindfulness on the facet interoception in adults (Casals-Gutiérrez & Abbey, 2020; Gibson, 2019; Hanley et al., 2017). The physical component in mindfulness refers more to inner satisfaction or a friendly, compassionate attitude towards the own body than to components such as endurance, speed, and physical appearance.

For social literacy, it would be useful to find other tests that measure the social component in a more differentiated manner, perhaps also including ratings from parents and teachers who have their own children's interaction with others in mind. However, bias could arise here from the sole knowledge that the children are participating in a mindfulness training. The FRKJ 8-16 was directly related to personal and social resources. It is possible that resources cannot change over a period of six weeks but are rather a fixed/trait construct that changes only after a longer time. To the best of our conscience and knowledge, there have been few, if any, studies at elementary schools that measure resources. When studies do address the topic of resources, they tend to measure subjective wellbeing, which is in general strongly associated with personal and social resources (Diener & Fujita, 1995). Amundsen et al. (2020) for example measured subjective wellbeing with the Student's Life Satisfaction Scale (SLSS) and the Sterling Children's Wellbeing Scale (SCWBS). The results showed that, compared to the waitlist or active control group, the mindfulness training significantly enhanced self-reported domains of well-being – positive outlook and life satisfaction – with medium and low effect sizes, respectively.

Finding a suitable measurement method for global literacy is not obvious. We decided to focus on connectedness to nature. Since we were not out in nature in the lessons with the children, but rather focused on sounds and theoretic considerations of the interconnectedness of the world and on life cycles, possibly the small changes cannot yet be measured in a test that is purely specialized in connectedness to nature. To our best knowledge, there exists only one study measuring environmental attitudes with the New Ecological Paradigm Scale for Children (Jalón et al., 2022). Here, after the MBI, significant improvements in pro-environmental

attitudes with large effects could be found. Jalón et al. (2022) implemented their program applied by homeroom teachers five minutes per week over four months including six types of sessions (theoretical, mindfulness practices, loving-kindness practices, compassion practices, metaphors, and transference). The program was based on immersion itinerary of mindfulness exercises, Mindful Self-Compassion Program, Compassion Focused Therapy, and Attachment-Based Compassion Therapy.

#### **5.4.2 Limitations and Future Research**

Several limitations of this study should be noted. One methodological limitation was that the entire project took place during the COVID-19 pandemic. Whether this fact effects differences in the results is difficult to judge retrospectively. Cullen et al. (2020) urged the development of interventions to mitigate the negative effects of the pandemic. Mindfulness meditation training has been suggested as one promising approach (Yuan, 2021). Thus, integrating mindfulness interventions into the school day may be a valuable measure to promote mental health in pandemic times (Butterfield & Roberts, 2022).

Another point is that the mindfulness assistant conducted the Flanker task in a one-to-one setting on the laptop. Because the children got to know the assistant better through the mindfulness training, there could be bias in posttesting. However, since there was no significant improvement in the three-way interaction group x time x condition, this assumption can be neglected. In any event, the collection of data from a person blinded to intervention status could provide a more objective measure of children's behaviors (Schonert-Reichl et al., 2015).

Furthermore, the use of mostly self-reported measures could be criticized. In the implementation of studies with children, it is often difficult to collect objective biological markers or conduct examinations with fMRI or EEG to measure changes in specific brain regions, since the consent of the parents must be given each time. The collection of blood, saliva or hair or the use of scanners tends to reduce the probability of participation in the project.

However, from the researcher's side, it would be very interesting to study brain regions. In adults, for example, it was shown that regular mindfulness training can lead to functional as well as structural changes in the brain of untrained people within a few weeks (Tang et al., 2015). In the long term, it is also shown that the thickness of certain cortex areas increases (Michaelsen & Esch, 2021). Because in children of that young age group, more neuroplastic change is occurring, brain research could provide important insights.

Besides, another limitation is that children could not be randomly allocated to the intervention or control groups. The intervention and control groups consisted of already-existing homeroom classes. This is due, on the one hand, to the nature of a field study and the required adaptation of the study's procedures to the specifications of the schools and, on the other hand, to the pandemic situation, during which an exchange between the pupils of the existing school classes would not have been feasible. Therefore, it cannot be eliminated that the differences between groups are due to differences in the functioning of the classes as different clusters (Jalón et al., 2022). For future studies that are no longer subject to pandemic regulations, it would be useful to implement randomized controlled trials (RCT). On the other hand, it could be also argued that the use of intact classrooms is appropriate in the context of school-based research. Implementing MBIs within an established social group is likely part of its effect so that random assignment of individuals to MBIs would not likely be an appropriate representation of its effectiveness.

In addition, van de Weijer-Bergsma et al. (2012) point out that children's participation after the parents' invitation, results in a selective sample that makes it difficult to draw generalizations for the population as a whole. However, in our study, almost the entire class participated. In field studies in general, the internal validity is lower compared to laboratory experiments since there is less control of possible confounding factors. Nevertheless, results in field research conducted in the natural environment of the subjects argue for higher external

validity and better generalizability. Finally, as in most studies, larger samples and multiple schools could provide higher power.

### **5.4.3 Future Directions**

Since this study involved fourth graders who moved on to secondary school after the school year, follow-up testing was not possible for organizational reasons. Six months after the mindfulness training, teachers shared that the pupils continued to engage in mindfulness practices, suggesting a sustainable implementation to explore in future projects. Follow-up testing and studies could provide further important insights. In several studies, even larger effects have been obtained in follow-up measurements with children (Amundsen et al., 2020; van de Weijer-Bergsma et al., 2012; Vickery & Dorjee, 2016), and with adults (e.g., Geiger et al., 2020).

Moreover, in addition to the passive control group, it would be useful to include an active control group (e.g., with relaxation techniques) in future studies to increase internal validity (Jalón et al., 2022). Butterfield and Roberts (2022) assumed an overestimation of the positive effects due to mindfulness compared with a passive control group who took part in their standard school routine.

Furthermore, the influence of different mindfulness interventions on cognitive, emotional, and bodily-based processes could be worthwhile to investigate.

For the acquisition of participants in subsequent studies, creating a video with some exercises and voices of children who have already participated in a MBI could be considered. This may give parents and children a better idea of what is content of a mindfulness training and could increase interest and willingness to participate.

### **5.4.4 Implications for Practice**

To create optimal learning environments in schools, involving the entire school family in the topic of mindfulness may be desirable. For a sustainable, long-term implementation the



teachers should be involved in the training and not only participate but also train themselves in mindfulness to at least teach mindfully and, in a later step, to teach mindfulness. Hawkins and Burke (2021) suggested three levels for successfully integrating mindfulness in the education system: (a) being mindful, (b) teaching mindfully, and (c) teaching mindfulness. In Step 1 and 2 the term mindfulness is not even used; here it concerns the attitude of the teacher. Often it is more important how something is taught than what is taught. Some studies also showed positive effects for teachers from an MBI (Crain et al., 2017; Flook et al., 2013). At any time, voluntarism is a big and important issue when integrating mindfulness in the education system. In no case should teachers have to teach mindfulness if they themselves do not stand behind the concept. A joint introductory event with practical content for the entire school community is recommended because everyone gets the same insight, and prejudices can be counteracted.

#### **5.4.5 Conclusion**

In conclusion, the mindful education workbook (Rechtschaffen, 2016) is a good program for elementary schools. Further research in the best case with objective markers is needed to investigate individual aspects under the umbrella term of mindfulness. MBIs in general can be used as a viable and effective method for children and adolescents in school settings (Greenberg & Harris, 2012). The great diversity in studies to date can perhaps be well justified by the following statement. „Mindful awareness training is a unique subject that is also uniquely subjective.” (Hawkins & Burke, 2021, p.13). Each school setting is unique and needs an individualized approach to bring mindfulness into the school community. Mindfulness could contribute as one of many important ways to create awareness and well-being. With these experienced skills, children can become aware of the important concern of how to share our one planet in a way that life remains worth living. Awareness that we do not live separately from planet Earth, but everything in this eco system is connected can promote the school children’s sense of responsibility for planet Earth, fellow human beings, and other species.

## 6 General Discussion

### 6.1 Summary

The aim of this thesis was to gain further insights into the effects of MBIs in German educational settings. In the first study, we focused on the target group preschoolers (3-6 years) implementing the *mindfulness-based KC* (Healthy Minds Innovations, Inc., 2017) and investigating its effects on EFs and socio-emotional competencies. In the course of the first study a translation and adaptation of the mindfulness-based KC (Healthy Minds Innovations, Inc., 2017) into German resulted. The adapted German version entitled *Achtsame Herzlichkeit im Kindergarten. Kindern helfen, emotionale Intelligenz und Resilienz zu entwickeln* was published as a book by Arbor Verlag (Portele & Jansen, 2021). The adapted version is intended to expand the use and reach of the KC and to provide easier access in German-speaking countries as well. In the first study, socioemotional competencies with the subscales *primary*, *secondary emotions*, and *prosocial behavior* improved for children in the mindfulness group compared with the control group (Portele et al., 2023). These results are according to the model of Hölzel, Lazar, et al. (2011) and two of the described components, emotion regulation and perspective changes. The children of the mindfulness group enhanced in recognizing basic and more difficult emotions and in finding prosocial solutions. The mindfulness group showed no better performance concerning EFs (inhibition) than the control group.

Because significant results were obtained in the first study primarily with regard to the socio-emotional component, we wanted to further disaggregate the possible effective factors of mindfulness in a next step and also divided socio-emotional into social and emotional measurements. Furthermore, we speculated that the specific content of the intervention, such as heartfulness-based mindfulness, determines which domains of human experience and behavior are impacted by the intervention. Therefore, in the second study with an older target group of elementary school children (8-11 years) the effects of an adequate mindfulness intervention *the*

*Mindfulness Education Workbook* (Rechtschaffen, 2018) was examined. Compared to the first study, more specific components of mindfulness were explored. For this reason, the deliberately chosen mindfulness program is based on five literacies (physical, mental, emotional, social, and global) and is partly in line with the four components (body awareness, attention regulation, emotion regulation, and change in perspective on the self) suggested by Hölzel, Lazar, et al. (2011). In the second study, for the five examined components emotion regulation, resources, attentional processes, bodily based processes, and connectedness to nature, the results for emotion regulation were most promising. In the FEEL-KJ most of the variables of the adaptive strategies revealed significance in favor to the mindfulness-plus and mindfulness groups compared with the control group. No evidence could be found that the additional practice in the mindfulness-plus group significantly added to the intervention's effectiveness.

In conclusion, there is a commonality in the results across both studies. Significant effects do seem to be strongest on reports related to emotion and socio-emotional components which is a promising finding (Portele et al., 2023; Portele & Jansen, 2023). This is in line with the study of Zhang et al. (2019) in a Chinese sample even with another study design focus. They examined the role of mindful parenting regarding emotion regulation in preschool children. Dispositional mindfulness was related to mindful parenting and parent-child attachment and subsequently lower emotional lability/negativity and higher emotion regulation in preschoolers. Indirect paths from mindful parents and parent-child attachment to preschool children's emotional lability/negativity and adaptive emotion regulation were significant. A review about mindfulness for adolescents and emotion regulation exists, even research in that field is limited (Broderick & Jennings, 2012). In the *Handbook of Emotion Regulation* Farb et al. (2014) describe mindfulness interventions and emotion regulation, theoretical foundations and mechanisms how MBI could support emotion regulation. Here, mindfulness is conceived as a regulative strategy, initially promoting attention development and consequently very good regulation techniques with (1) increased access to sensory representation; (2) decreased

activation of a network for habitual self-elaboration; and, in long-term practitioners, (3) increased attentional stability and decreased reactivity to emotion provocation (Farb et al., 2014). In a study with different effects of ethical education, physical hatha yoga, and mantra meditation, overall, the student's well-being (may be connected with healthy emotion regulation skills) increased the largest (Matko et al., 2021).

The finding of the emotion regulation improvements can be explained in part by the mindfulness-to-meaning theory (Garland et al., 2015). With this theory, Garland et al. (2015) try to explain how the practice of mindfulness affects downstream emotion regulatory processes. Considered in a further step, this can impact the sense of meaning in life. In the form of an upward spiral, the process model of mindful positive emotion regulation is represented. The spiral develops over time and is based on increased magnitude and depth of eudaimonic wellbeing. In brief form, the spiral develops as follows which is affected by mindfulness practice: Decentering from stress appraisals, positive reappraisal of stressors, positive emotions, leading to adaptive or prosocial action, and meaningfulness in life.

In conclusion and to create a transfer, the focus on socio-emotional development is an essential cornerstone for every society. In today's educational climate, educational policymakers are often focused on learning, teaching, and cognitive development and do not esteem the meaning of socio-emotional development. Here can be also supplemented the criticism of a study that mindfulness in the form of "MacMindfulness" is often used only as performance optimization (van Dam et al., 2018). This is counteracted by both our studies in pre- and elementary school (Portele et al., 2023; Portele & Jansen, 2023). They can be seen as a key step toward supporting an educational policy that is aware of the necessity of explicit, scientifically sound social-emotional education in early education.

## **6.2 Limitations and Implications for Future Research**

As it is the case with scientific projects, even with the most meticulous planning, it is only the implementation that reveals the limits of the study design. Thus, possible limitations

of the two studies should be pointed out here, which allows a better placement of the results in the overall context. Some findings from the first study were directly implemented in the second study. Furthermore, the lessons learned from the two conducted studies provide guidance and implications for future studies.

Whereas in the first study the socioeconomic questionnaire of Jöckel et al. (1998) was utilized, in the second study, we used a more recent and more detailed questionnaire of Lampert et al. (2018). The socio-economic status was generated as a household characteristic based on parental information on the three scales: education, occupation, and income. However, some parents considered the disclosure of income too sensitive, resulting in missing values. Riphahn and Serfling (2005) confirm that some of the respondents generally do not provide information on their income situation, which may lead to a systematic bias. In future studies with an SES survey, parents could be informed about the reasons for such a questionnaire in the form of an information evening or in writing, which could lead to a higher compliance. Nevertheless, we considered it important to collect the SES, as the SES in childhood predicts e.g., EFs (Hackman et al., 2015), and growing up in families with a low SES impacts children's cognitive development. Therefore, we collected the SES to preclude the possibility of differences between the intervention and control groups. Otherwise, possible differences in the aspects of mindfulness might also have been due to differences in the SES.

In the first study, there were technical problems with the recording of reaction times in both computer-based tests. Testing the Go-No Go task with kindergarten children, sensors that are less delicate should be considered. Because with children at this young age, some press very hard on the touchpad, while others only press very lightly. Instead of the touchpad, big colored buttons for children could be used, which can be externally connected to the laptop. The normal keys on the computer keyboard are altogether slightly more difficult to press with the still smaller coordinative abilities of the young children. No technical problems were encountered in the second study in the elementary school.

Part of the study in kindergarten took place before the COVID-19 pandemic. The start of the second part of the investigation in another kindergarten had to be postponed again and again due to the pandemic. The start of the second study in the elementary school was also impacted by the pandemic and had to be postponed several times until external trainers were allowed to enter the school again. Overall, we hypothesize, that it was useful to conduct the two studies during the pandemic, provided of course that infection numbers and infection control measures allowed. Conversano et al. (2020) reinforce the protective effects of mindfulness in the COVID-19 pandemic. Besides many restrictions for the children of the society, especially early in the pandemic, MBIs are one way to mitigate negative effects of the pandemic situation (Yuan, 2021).

In both studies the control groups were passive (wait-list) control groups. To increase internal validity, passive and active control groups (e.g., with relaxation techniques or mindful movement or yoga) are recommended (Jalón et al., 2022). Butterfield and Roberts (2022) even presume an exaggeration of the beneficial effects due to mindfulness compared to a passive control group receiving the business as usual. In the second study for example, instead of the second more intensive mindfulness intervention group, it would be worth considering to extend the passive control group with an active control group in the study design.

For ethical reasons, wait-list control groups are preferable because they also receive the intervention following the "waiting period". Especially in mindfulness-based programs, where positive effects can be assumed, it can be to the advantage of all children participating in the intervention to benefit from it. In the first study, we were able to implement it in this way. In the second study, however, due to the postponement of the start of the intervention because of the COVID-19 pandemic, and the natural limit due to the end of the school year, the control group could only receive a sample session to experience mindfulness exercises.

In both studies, besides the computer-based tasks, self-reported measures were used, which as well is a point worth to discuss. In behavioral research the reliability of all self-report

measures is limited by biases in self-perception (Baumeister et al., 2007). However, from another point of view, there is an advantage in questionnaire research with children because the younger the children, the less social desirability occurs (Hitchcott et al., 2020).

On the one hand, the internal validity is lower in a field study compared to a laboratory experiment since possible confounding factors can be controlled less. On the other hand, results in field research that take place in the natural environment of the subjects may argue for a higher external validity and thus a better generalizability of the findings. There is controversial discussion on this regarding laboratory and field experiments (List, 2020; Lucas, 2003).

The first study is limited by the small sample size because of drop-out. The power analysis was conducted for large effect sizes because they seemed to be of practical relevance. However, because we did not find effects for EFs, this only means that there was no possible large effect. A larger sample is necessary to search for smaller or medium-sized effects.

### **6.3 Outlook for Future Research and Open Questions**

A new systematic review aimed the assessment of the current literature on MBIs in schools across specific outcomes (Phan et al., 2022). Seventy-seven studies with 12.358 students across five continents has been evaluated. The highest quality examined studies showed an increase in prosocial behavior, resilience, EFs, attention and mindfulness, and decreased anxiety, attention problems/ADHD behaviors and conduct behaviors. The outcomes for well-being were split, some studies showed increased well-being and some no improvement.

This recently published review shows once again that the field of mindfulness in the educational system is a promising research area with several remaining questions and many details for future research to explore and understand. Concerning this, the present work offers a further, small cornerstone for advancing scientific, applied research in the German-speaking area. It also provides a foundation on which further studies can be built, providing step-by-step further insights into the effects and use of MBIs in educational contexts. In the following section, potential directions for future research will be discussed and corresponding open

questions will be presented. Schonert-Reichl et al. (2016) indicate several future directions for research in schools which also can be transferred to the preschool and general educational context: Multiple-levels-of-analysis, rigor of research designs, measuring outcomes, developmental timing of trainings, dose-response relations, and process studies of programs. A few of those mentioned aspects for changes in future studies are selected and described in more detail. Longitudinal study designs for long-term effects of mindfulness would be useful. Herewith, it could be investigated whether people who have already participated as children in a mindfulness intervention continue to benefit from it in later life, have even dedicated themselves to mindfulness exercises again, or perhaps have no connection to it at all. Multimethod and multilevel approaches such as biological, psychological, behavioral, and contextual outcome measures could be integrated in future mindfulness research. Here, e.g., class structures as random effects could be included in the analyses. To do justice to interdisciplinary measurements, interdisciplinary teams with researchers from different fields would also be desirable. If MBIs are delivered in specific life spans, entitled as “windows of opportunity” in early childhood or adolescence, they may have long-lasting positive effects. Davidson and McEwen (2012) also assume such sensitive periods. Experiential factors shape the neural circuits on which social and emotional behavior is based beginning in the prenatal period and continuing through the end of life. The dose-response relationship is also important for further investigations especially when considering the time pressure that often exists in schools. It is still not known if a little everyday practicing or a lot of practice just some days is more effective. Here we tried to gain further insights in the second study with the subdivision into mindfulness-plus and mindfulness group. Since there was hardly any difference between the mindfulness group and the mindfulness-plus group in our study, this result could support a low-threshold implementation in the normal school routine. Besides, many subfactors should be further investigated. For example, what is the total amount of time of mindfulness training, how often per week delivered, how many repetitions? Or does the dose-response relationship



depend primarily on interindividual differences? In a recent study with university students, Matko et al. (2022) examined personality traits and meditation and yoga treatments. Using a cluster analysis, they discovered, that students with a more maladaptive personality structure enhanced their emotion regulation skills more. This may answer the question that peoples' benefit from MBIs differ because of their personality. More vulnerable persons or with high absorption seem to have more benefits from the mindfulness intervention. What else may influence the differences in benefitting concerning mindfulness within people and children? Some people and children may have a more mindful basic attitude, although they may never have heard the term mindfulness. There are people who more consciously perceive sounds, smells, and beautiful details in nature. Can mindfulness be seen as a trait or state? Kiken et al. (2015) suggest, that an increased state mindfulness, when repeating mindfulness exercises, could be helpful for a more mindful and less despairing attitude. The authors assume that individual paths of change may vary.

Further, it is important to examine in more detail which components of the mindfulness training specifically work. Here, partly open questions remain. To what extent for example does the trainer-student relationship play a role (Wanders et al., 2020), as is also of central importance in the therapeutic setting (Hall et al., 2010)? Moreover, is it more sustainable if the mindfulness training is delivered by internal or external trainers? Should teachers and educators, if there is interest, be more involved in the mindfulness sessions?

For further studies, it may be worth attempting to isolate further effect components of mindfulness. In the large-scale ReSource project, Singer and Engert (2019) sought to investigate whether differently targeted MBIs (a) present-moment attention and interoception, (b) socio-emotional processes such as compassion and loving kindness and (c) meta-cognitive processes and perspective-taking on self and others, effected distinct outcomes. Based on the research that compassion training showed positive effects on mood and health, possible increases in prosocial behavior were confirmed (Leiberg et al., 2011). The results of this project

yielded preliminary evidence for the positive impact of short-term compassion training on prosocial behavior.

#### **6.4 Implications and Conclusion**

Mindfulness programs are usually tailored to specific age groups. Between the age groups studied in our projects the difference on average was 4-5 years, preschool (3-6 years), and elementary school (8-11 years). Both age groups require an individual approach. In summary, the attention span of elementary school students is already significantly longer and more reflection on certain topics is possible.

Mindfulness and its components can also make a positive contribution in secondary schools, universities, and colleges. For example, a mindfulness-based student training (MBST), was developed specifically for universities, and its effectiveness has now been investigated in two studies (Voss et al., 2020; Voss et al., 2022). As the first two parts of the name of the training show, there is a major similarity to a MBSR class, but the student training has been extended to include social and ecological exercises and the whole course is adapted to the time standards of a university seminar. Thus, an MBST course lasts 12 weeks of 90 minutes each, including an introductory and final session, and a 5-hour Digital Detox Retreat.

MBIs, among many other important building blocks, can be a useful, promising addition in public education settings. Children particularly from households with lower socioeconomic status are more likely to have physical and mental health conditions. A study with adults raised in low-socioeconomic status households showed, that mindfulness meditation could improve health outcomes at-risk population (West et al., 2022). If improvements could occur even in adulthood, children at a young age from unequal backgrounds could benefit even more. Therefore, an implementation of mindfulness-based exercises and a public, simplified access through the education system could be of great importance and make change possible from the bottom-up.

“Mögen wir alle Liebe zeigen können.“ [May we all be able to show love.]

That sentence was the self-considered wish of an elementary school child in the loving kindness meditation in one of our mindfulness lessons. For example, this is a special goosebump moment during a MBI. This phrase should serve as a conclusion of this thesis, as it represents a key moment in working with children and mindfulness. Wonderful ideas and suggestions can emerge when children are given the confidence to lead the mindfulness exercises themselves. It immensely enriches the mindfulness training. Surprising moments, different approaches, new choices of words will be part of training making the world a little better and more flourishing.

## **7 Declarations**

### **7.1 Ethical Standards**

The first study was approved by the responsible ethics committee (19-1312-101). The experiment was conducted according to the guidelines of the declaration of Helsinki. Kindergartens were recruited and informed about the mindfulness project. Parents were provided with an information sheet and a consent form. They gave their written informed consent and data were processed anonymously. Children gave their verbal consent before testing.

The second study was approved by the responsible ethics committee (21-2175-101). The experiment was conducted according to the guidelines of the declaration of Helsinki. The elementary school was recruited and informed about the mindfulness project. School board, parents' council and school leadership gave their consent. Parents were provided with an information sheet and a consent form and afterwards gave their written informed consent for data processing.

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### **7.3 Competing Interests**

We have no conflicts of interest to disclose.

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