

CHILDREN'S SOCIOEMOTIONAL SKILLS

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International Journal of Positivity & Well-Being
Volume 3 Issue 2 (2025) Pages 156-185
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<https://doi.org/10.1016/j.pedn.2025.06.029>
(Database: ScienceDirect)

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A Systematic Review of Mindfulness Research with Preschool Children

Okul Öncesi Dönem Çocuklarıyla Yapılan Bilinçli Farkındalık (Mindfulness) Araştırmalarının Sistemik İncelenmesi

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Abstract

Mindfulness is a skill that enables individuals to accept their thoughts and feelings without judgement and to focus on their immediate experiences. It is important to determine the effects of mindfulness activities on children during the preschool period, as this is critical for their development. In this study, the systematic review method was used to examine the effects of mindfulness practices conducted with preschool children on their development. It is expected that the study will contribute to the scientific literature in terms of understanding the effects of mindfulness on children's different developmental areas and behaviours; it is also expected that it will serve as a guide on the development of educational programmes and intervention practices to support mindfulness skills at an early age. The research included scientific studies and theses on mindfulness in preschool children (36-72 months) in Google Scholar, YÖK Thesis Centre, Tandfonline, ProQuest, EBSCO, Wiley Online Library, MEDLINE, Sage Journals, DergiPark, and JSTOR databases, which were conducted between 2015-2025 and could be accessed in full text. The databases were searched using the keywords "mindfulness" and "preschool" in English and "okul öncesi," "mindfulness," and "bilinçli farkındalık" in Turkish, which were determined by considering the subject title and the relationship with the purpose of the study. As a result of the search, 51 sources, 11 theses, and 40 studies were included in the review. The research results show that mindfulness-based programs have the potential to positively affect children's executive functioning, self-regulation skills, and social-emotional development. This study highlights the importance of early interventions and offers evidence-based guidance for future educational programs.

Keywords: Preschool, Early Childhood, Mindfulness, Systematic Review

Öz

Bilinçli farkındalık (mindfulness), bireyin duygu ve düşüncelerini yargılamadan kabul etmesini ve anlık deneyimlerine odaklanmasını sağlayan bir beceridir. Çocukların gelişimleri açısından kritik öneme sahip olan okul öncesi dönemde uygulanan bilinçli farkındalık çalışmalarının, çocuklar üzerindeki etkilerini saptamak önem arz etmektedir. Bu çalışmada, okul öncesi dönem çocuklarıyla yürütülen bilinçli farkındalık uygulamalarının çocukların gelişimleri üzerindeki etkilerini ortaya koymak amacıyla sistemik derleme yöntemi kullanılmıştır. Yapılan çalışmanın, bilinçli farkındalığın çocukların farklı gelişim alanları ve davranışları üzerindeki etkisini anlamaya yönelik olması bakımından bilimsel literatüre katkı sağlayacağı; ayrıca, erken yaşta bilinçli farkındalık becerilerini desteklemeye yönelik eğitim programları ve müdahale uygulamaları geliştirilmesine ışık tutması açısından yol gösterici olacağı beklenmektedir. Araştırmaya, 2015-2025 yılları arasında gerçekleştirilmiş ve tam metin olarak erişilebilen; Google Akademik, YÖK Tez Merkezi, Tandfonline, ProQuest, EBSCO, Wiley Online Library, MEDLINE, Sage Journals, DergiPark ve JSTOR veri tabanlarında yer alan; okul öncesi dönem (36-72 ay) çocuklar ile bilinçli farkındalık (mindfulness) konulu bilimsel araştırmalar ve tezler dahil edilmiştir. Veri tabanlarında konu başlığı ve çalışmanın amacıyla ilişkisi göz önünde bulundurularak belirlenen İngilizce "mindfulness", "preschool" ve Türkçe "okul öncesi", "bilinçli farkındalık", "mindfulness" anahtar sözcükleri kullanılarak tarama yapılmıştır. Tarama sonucunda incelemeye 11 tez ve 40 araştırma olmak üzere toplam 51 kaynak alınmıştır. Araştırma sonuçları, bilinçli farkındalık (mindfulness) temelli programların çocukların yürütücü işlevleri, öz düzenleme becerileri ve sosyal-duygusal gelişimleri üzerinde olumlu etkiler yaratma potansiyeline sahip olduğunu göstermektedir. Bu çalışma, erken müdahalelerin önemini vurgulamakta ve gelecekteki eğitim programları için kanıta dayalı rehberlik sunmaktadır.

Anahtar Kelimeler: Okul Öncesi Dönem, Bilinçli Farkındalık, Mindfulness, Sistemik İnceleme



Introduction

The preschool period is considered a stage of life during which developmental domains are more closely interrelated than at any other time, and the foundation for many essential life skills is established. It has been scientifically demonstrated that this period is characterized by both significant opportunities and major risks, and its influence extends across the lifespan (Shonkoff, 2010). In this regard, the quality of education provided during preschool years and the development of skills necessary for navigating a rapidly changing and evolving world are of critical importance. Among the 21st-century skills, the concepts of adaptability and emotional resilience have gained prominence. The classroom environment and teachers' practices play a vital role (Jennings, 2019).

Mindfulness has emerged as a concept that helps individuals cope with various difficulties and stressors, contributing to their psychological balance and enhancing their ability to remain present in the moment (Napoli, 2004). Children who participate in mindfulness practices at an early age demonstrate significant gains in emotional and social development. These gains include increased empathy, improved skills in recognizing and expressing emotions, and the use of more effective emotion regulation strategies. Children who develop mindfulness skills tend to remain calmer in stressful situations and show greater resilience in the face of challenges. These outcomes are suggested to enhance the likelihood of exhibiting positive behaviors and maintaining emotional well-being in later years (Duff, 2024).

According to Kabat-Zinn (2005), mindfulness is “the state of being in the present moment with an open and non-judgmental attitude” (p. 14). Killingsworth and Gilbert (2010) emphasized that individuals often dwell on the past or worry about the future, which prevents them from noticing the present moment. This pattern of thinking may have a negative impact on well-being. Mindfulness practices offer a structured way to refocus attention and reconnect with internal strengths such as calmness, resilience, and clarity (Kabat-Zinn, 2005). Mindfulness practices have been shown to positively influence children's abilities to recognize, regulate, and accept their thoughts and emotions; to act according to their emotional states; to demonstrate empathy; and to manage negative behaviors (Erten & Güneş, 2024).

In contrast to the sense of separation created by cognitive awareness, sensory-based attention provides a shared foundation that supports social connection among individuals. Mindfulness-based practices contribute to strengthening the role of sensory awareness in daily life by enhancing individuals' interaction with the external world (Carmody, 2015). Mindfulness is regarded as an enlightening, liberating, and empowering approach for individuals. It illuminates aspects of one's life that are often avoided or overlooked, allowing individuals to clearly perceive the realities that they might otherwise suppress. It is liberating in that it transforms the way individuals interpret themselves and the world, helping them to break free from recurring behavioral and cognitive patterns. By intentionally directing attention, mindfulness also empowers individuals by granting access to deep inner resources, such as creativity, intelligence, imagination, clarity, determination, the capacity for conscious decision-making, and wisdom (Kabat-Zinn, 2005).

Children are often regarded as natural masters of mindfulness due to their innate "present-moment intelligence" (Snel, 2019). However, as they grow older, their tendency to reflect on the past or imagine the future can diminish or suppress this inherent ability. It has been noted that “mindfulness training in children, like language learning, is more effective the earlier it is introduced” (Atalay, 2019, p. 117). Sustaining the desire to remain in the present moment through mindfulness practices during early childhood is of critical importance. Mindfulness programs designed for children play a significant role in guiding the development of fundamental human capacities and promoting holistic growth (Snel, 2019).

Mindfulness practices in early childhood have been found to positively influence children's executive functions (Li et al., 2019; Aydın & Özbey, 2022; Shlomov et al., 2023; Xie et al., 2022, 2024; Rajbhandari,

2023), as well as their emotion regulation and self-regulation skills (Paslı & Temel, 2024; Berti & Cigala, 2022; Türkent, 2023; Tonga Çabuk, 2023; Berger et al., 2024). In this context, scientifically examining mindfulness practices implemented inwith children is essential for the development and widespread implementation of effective educational programs.

A review of the literature reveals that mindfulness studies have been conducted with preschool children, and that existing systematic analyses tend to focus on the impact of mindfulness on specific developmental domains. However, no comprehensive systematic review has been identified that examined all mindfulness-based interventions implemented in preschool-aged children. The present systematic review aims to contribute significantly to the literature by examining the effects of mindfulness practices on the overall development of preschool children. Furthermore, mindfulness applications during the preschool years are expected to serve as a guide for researchers to identify new research directions related to supporting various developmental domains through early interventions.

The following questions were addressed in this study:

1. How is the distribution of studies on mindfulness to be analysed within the scope of the research according to years and types?
2. What is the distribution of studies on mindfulness to be analysed within the scope of the research according to the countries and types of studies conducted?
3. What is the distribution of the programs applied in the studies conducted on mindfulness to be analyzed within the scope of the research according to the duration of implementation?
4. What is the distribution of the studies conducted on mindfulness to be analysed within the scope of the research according to the ages of the participants?
5. What dimensions have been examined in studies on mindfulness within the scope of this research?

Method

This study presents a systematic review of research examining the effects of mindfulness practices on preschool children aged 36–72 months old. A systematic review is a type of research that systematically and transparently identifies, selects, and critically appraises relevant studies to address a specific research question. During the review process, data from the included studies were extracted and analyzed (Moher et al., 2009). The data for this review were structured using the PICOS framework and were reported in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

PICOS Approach

The PICOS approach is a widely used framework in systematic reviews for structuring research questions, defining eligibility criteria for study selection, and guiding the analytical process. By clearly outlining the criteria for study inclusion and the outcomes to be assessed, PICOS contributes to making systematic reviews more comprehensive, transparent, and methodologically robust (Methley et al., 2014).

The "Participants" component of the PICOS framework refers to defining the target group included in the study. This study included typically developing preschool children aged 3 to 6 years (36–72 months) who participated in mindfulness-based interventions. Children with special needs were excluded from the review because they may have demonstrated different patterns of developmental responses to mindfulness interventions.

The "Interventions" component refers to the programs implemented directly with the participants. This review included studies that administered mindfulness-based interventions directly to preschool children aged 3–6 years (36–72 months). Studies in which mindfulness interventions were delivered to parents or preschool teachers with the aim of indirectly assessing effects on children were excluded.

The "Comparisons" component involves evaluating the outcomes of groups that received mindfulness interventions in comparison to those that received either standard educational programs or no intervention. This review included studies that compared mindfulness intervention groups with control groups that received traditional teaching methods or no training. Studies without control groups or valid comparison conditions were excluded.

The "Outcomes" component refers to the targeted outcomes examined in the studies. The included studies focused on evaluating the effects of mindfulness practices on children's developmental domains or specific skills.

The "Study Design" component encompasses the methodological characteristics of the included studies. This review incorporates empirical research articles and theses published in either Turkish or English. Meta-analyses, literature reviews, book chapters, and web-based content were excluded. The PICOS criteria established in this review are listed in Table 1.

Table I. Design Of The Research According To PICOS Criteria

PICOS element	Inclusion Criteria	Exclusion Criteria
P (Population/Participants)	Healthy developing children receiving mindfulness interventions in preschool period (3-6 years, 36-72 months)	Children with special needs
I (Intervention)	Mindfulness practices (group, individual sessions, play-based practices, etc.).	Studies in which the effects of the programme applied to parents or preschool teachers on children were determined
C (Comparison/Comparisons)	Studies comparing control groups receiving and not receiving mindfulness practices or groups receiving traditional teaching methods	Non-comparative research
O (Outcome/Results)	Studies examining the effects of mindfulness practices on children's developmental areas or skills	
S (Study Design):	Research studies in Turkish and English (articles, theses)	Systematic reviews, meta-analyses, book chapters, web site news

PRISMA Guide

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were developed to ensure transparent and complete reporting of systematic reviews (Page et al., 2021).

In the identification phase, studies suitable for inclusion were identified through a comprehensive screening process. For this review, both research articles and theses on mindfulness practices with preschool children aged 36–72 months were identified through searches of multiple academic databases and search engines. These included Google Scholar, YÖK Thesis Center, Taylor & Francis (Tandfonline), ProQuest, EBSCO, Wiley Online Library, MEDLINE, Sage Journals, DergiPark, and JSTOR. The search covered the period from 2015 to 2025 and included only full-text accessible sources. Keywords used for the search were determined based on the alignment between the study objective and the topic, and included: “mindfulness” and “preschool” (English); “mindfulness”, “mindful awareness”, and “okul öncesi” (Turkish). The search yielded a total of 736 records: 410 from Google Scholar, 8 from YÖK Thesis Center, 154 from Tandfonline, 54 from ProQuest, 67 from EBSCO, 8 from Wiley, 21 from MEDLINE, and 4 each from Sage Journals, DergiPark, and JSTOR.

All records were imported into EndNote, and 95 duplicates were removed. A total of 549 records were excluded after content screening due to irrelevance. The remaining 94 studies were then assessed in detail. Of these, 8 were excluded for involving children outside the 36–72 month age range, and 35 were excluded for methodological reasons (e.g., inclusion of children with special needs, indirect application via parents or teachers or lack of a control group). Finally, 51 studies met the inclusion criteria and were included in the final review. A PRISMA flow diagram is shown in Figure 1.

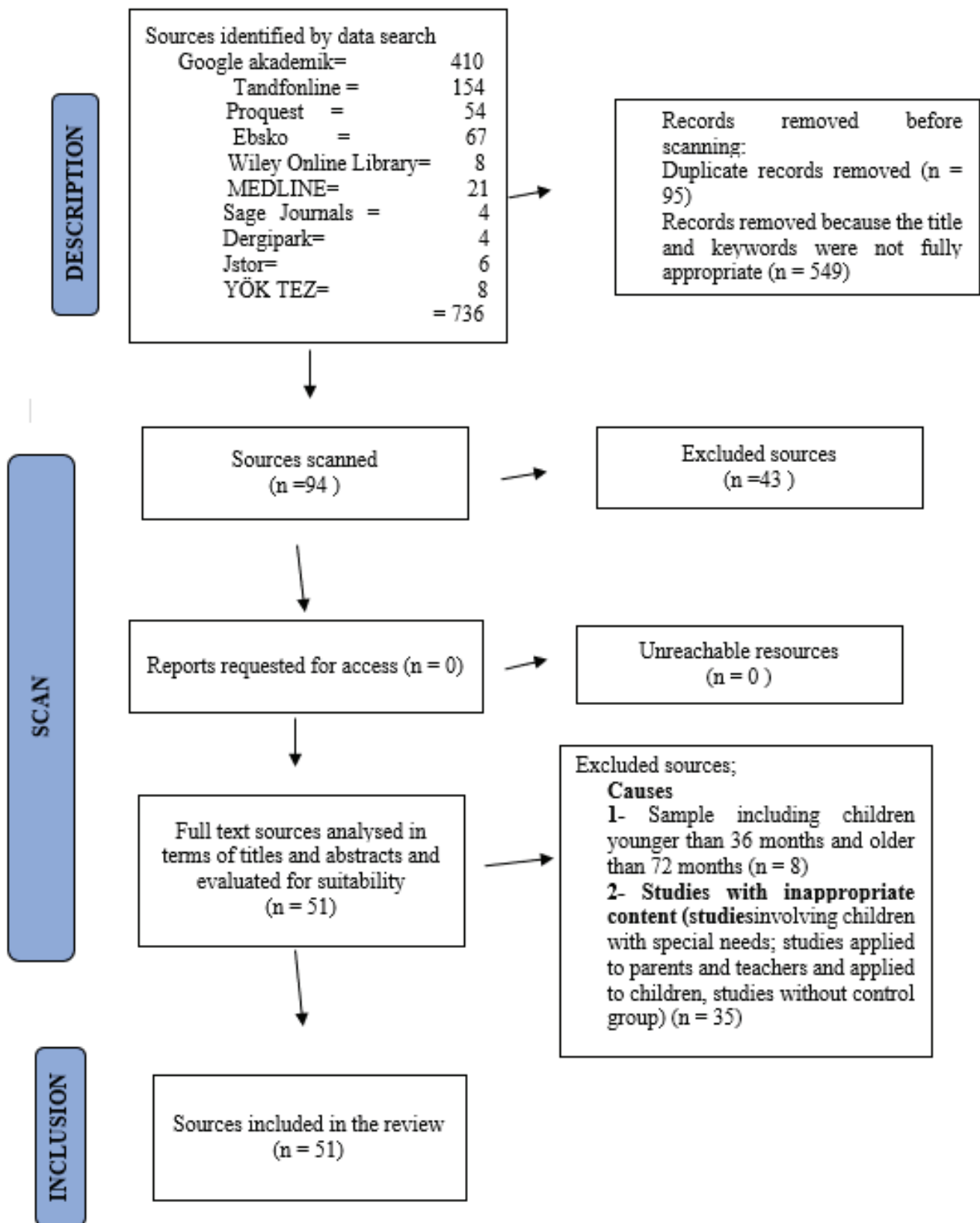


Figure 1: PRISMA Flowchart

Results

In this section, the systematic analysis data of the studies included in the scope of the study are categorised in accordance with the sub-objectives formed in line with the purpose of the study and presented in the findings.

1. Distribution of Studies on Mindfulness According to Years and Types

In line with the first research question of the systematic review, Figure 2 presents the distribution of mindfulness-related studies included in the analysis according to their publication years and types.

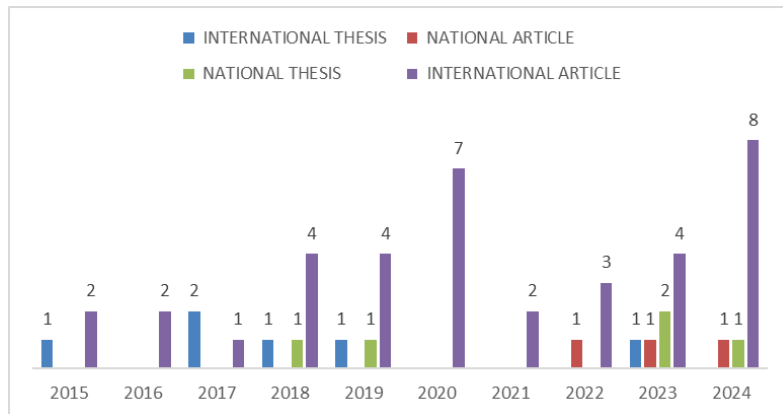


Figure 2. Distribution of Studies on Mindfulness According to Years and Types

Figure 2 presents the distribution of national articles, international articles, national theses, and international theses by publication year between 2015 and 2024. According to the data, international articles constitute the most frequently published type of work, with a notable increase observed in 2018 and 2024. Although the number of national articles has remained relatively low, the number of international theses has shown little variation over the years. By contrast, national theses have demonstrated an upward trend since 2022. Overall, it can be concluded that there is a strong interest in publishing international articles.

2. Distribution of Studies on Mindfulness According to Years and Types

In line with the second research question, Figure 3 presents the distribution of mindfulness-related studies included in the analysis by country and publication type.

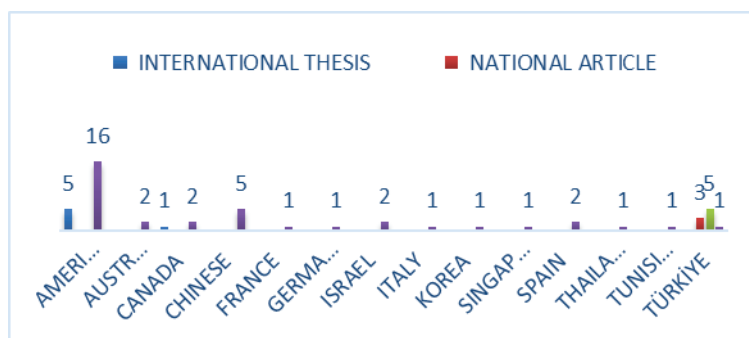


Figure 3: Distribution of Studies on Mindfulness According to Years and Types

An analysis of the distribution of mindfulness studies conducted with preschool children by country

revealed that the highest number of studies were conducted in the United States. In Türkiye, the relatively comparable numbers of articles and theses suggest that the topic of mindfulness has been addressed in a balanced manner across different academic publication types. By contrast, countries such as Germany, Australia, China, France, Spain, Israel, Italy, Canada, South Korea, Thailand, Singapore, and Tunisia appear to have conducted fewer studies in this area. Overall, the findings indicate that mindfulness research varies in intensity across countries, with the United States leading in terms of published articles, whereas Türkiye stands out in the number of thesis-based studies.

3. Distribution of the Programmes Implemented in the Studies on Mindfulness According to the Duration of Implementation

In line with the third research question, Figure 4 presents the distribution of the mindfulness programs included in the analysis according to their implementation duration.

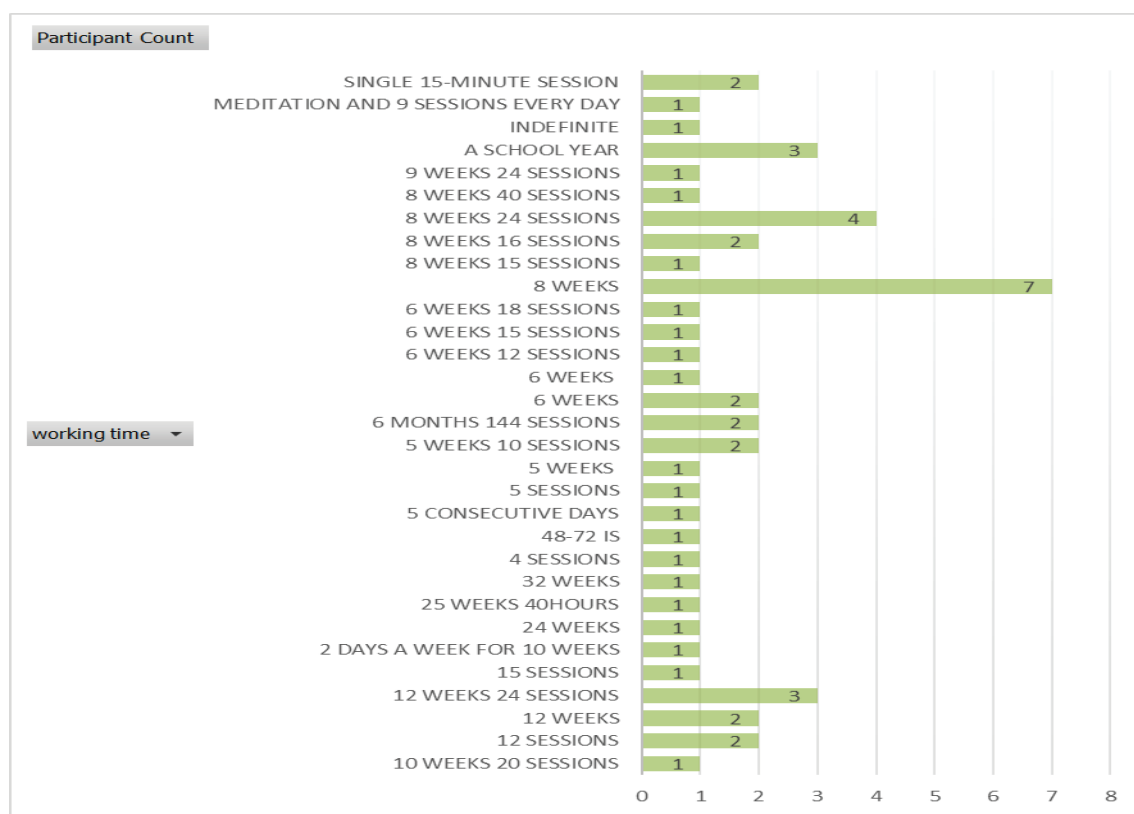


Figure 4: Distribution of the Programmes Implemented in the Studies on Mindfulness According to the Duration of Implementation

An examination of the distribution of program duration in mindfulness studies conducted with preschool children revealed that the majority of the interventions were implemented over an eight-week period. The longest program lasted for one year, while the shortest program consisted of a single 15-minute session.

4. Distribution of Participants According to Their Ages in Studies Conducted on Mindfulness

In line with the fourth research question, Figure 5 presents the age distribution of the participants in the mindfulness studies included in the analysis.

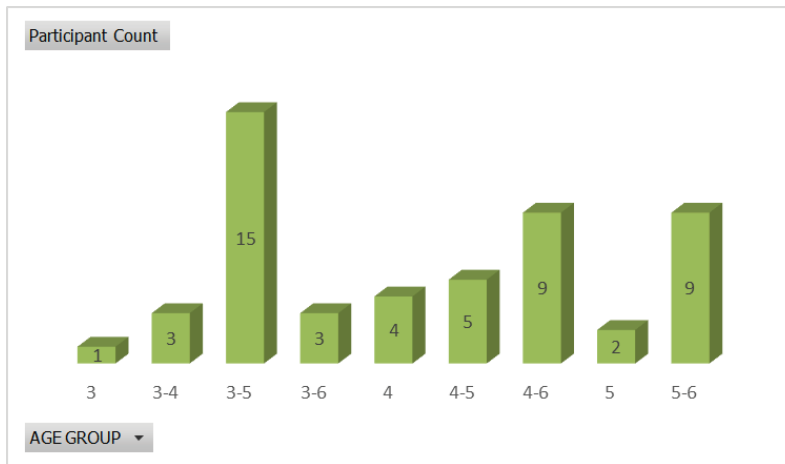


Figure 5: Distribution of Participants according to Age in Studies on Mindfulness

An analysis of participant distribution in mindfulness studies conducted with preschool children revealed that the 3–5 age group was the most frequently studied group, with a total of 15 studies. Additionally, a large number of studies focusing on the 4–6 and 5–6 age groups were also observed.

5. Dimensions of Relationships Analysed in Studies on Mindfulness

In line with the fifth research question, Table II presents the dimensions of the interrelationships examined in the mindfulness studies included in the analysis.

Table II: *Dimensions of Relationships Analysed in Studies on Mindfulness*

TOPICS EXAMINED	NUMBER OF STUDIES
Academic Performance	1
Anxiety, Social Emotional Behavior, Executive Functions	1
Attention	1
Attention And Social-Emotional Competence	1
Attention Control	1
Behavioral And Attention Regulation	1
Behavioral Problems, Adaptation Skills And Executive Functions	1
Being Careful, Being Calm, Behaving With Self-Control, Accepting And Loving Oneself, Being Caring And Helpful To Others	1
Cognitive Flexibility, Impulse Control, Working Memory	1
Emotional Intelligence	1
Emotional Resilience, Social-Emotional Well-Being And School Readiness	1
Endurance, Social Behavior And Motor Skills	1
Executive Functions	6
Executive Functions And Peer Conflict	1
Executive Functions, Eating Behaviors	1
Executive Functions, Self-Regulation	1
Executive Functions, Social Emotional Skills	1
Executive Functions, Social Skills	1
Food Neophobia	1
Internalization, Externalization, Prosocial Behaviors And Executive Functions	1
Mental Health, Self-Management, Social Emotional Skills, Executive Functions	1
Prosocial Behavior	2
Prosocial Behavior, Self-Regulation	1
Prosocial Behavior, Self-Regulation, Perspective Taking	1
Prosocial Behaviors And Hyperactivity	1
Psychological Well-Being	1
Psychosocial Adaptation And Neuropsychological Development	1
School Adaptation; (2) School Behavior Problems; And (3) Academic Outcomes.	1
School Maturity	1
Self Regulation	7
Self-Regulation, Body And Emotional Awareness, Self-Calming, Empathy, And Sensitivity To The Emotions Of Others.	1
Self-Regulation, Empathic Behaviors	1
Self-Regulation, Social Skills	1
Social Behaviors	1
Social Skills And Adaptability, Depression, Anxiety, Inattention And Hyperactivity	1
Social-Emotional Behaviors	1
Social-Emotional Skills	1
Social-Emotional Skills, Executive Function And Academic Skills	1
Well-Being, Self-Regulation, Sleep, Behavioral Problems, Academic Skills	1
Grand total	51

When the studies evaluating the effects of mindfulness-based interventions conducted with preschool children were categorized under general themes, 12 research articles (A35, A16, A39, A20, A29, A23, A6, A21, A1, A36, A37 and A31) and 2 theses (T5 and T11) were identified as focused on executive function skills. Additionally, 7 research articles (A28, A13, A15, A27, A19, A26 and A40) and 6 theses (T8, T4, T9, T10, T2 and T6) investigated the effects on self-regulation and related skills. A significant portion of the studies—19 research articles (A17, A11, A38, A25, A30, A22, A7, A8, A14, A24, A34, A2, A3, A12, A4, A18, A10, A33 and A32) and 1 thesis (T3) focused on the development of social-emotional skills. In addition studies have examined various other outcomes such as attentiveness/focus, calmness, self-controlled behavior, self-acceptance and self-love, and prosocial behaviors such as caring for and helping others. Moreover, the relationship between mindfulness practices and eating problems was explored in studies A9 and A5, whereas school readiness was addressed in thesis T7.

Discussion

Studies examining the effects of mindfulness practices on preschool children have predominantly focused on dimensions related to executive functions, self-regulation skills, and social-emotional development. Within the context of executive functions, these studies have addressed components such as attention, attention regulation, cognitive flexibility, impulse control, and working memory. Additionally, the relationship between executive function skills and peer conflict has been explored.

The effects of a twelve-session mindfulness training program on the components of executive functions,—namely attention, impulse control, working memory, and cognitive flexibility,—were investigated. Li et al. (2019) reported that the mindfulness program particularly strengthened preschoolers' attention and flexibility in managing impulses and tasks. Similarly, according to Aydın and Özbey (2022), preschoolers who participated in mindfulness activities exhibited noticeable gains in sustaining attention, controlling impulses, and retaining information over short periods."Moreover, several studies have examined the effects of mindfulness training on both hot and cold executive functions. The findings suggest that such interventions are particularly effective in tasks involving emotional regulation, which are associated with hot executive functions (Rajbhandari, 2023).

The literature also includes structured mindfulness programs such as the Mini-Mind Program, which has been assessed for its practicality and acceptance among educators and children alike. This study examined the effects of the program on key components of executive functioning, including attention, working memory, impulse control, and cognitive flexibility.

Data obtained from indirect measures revealed small -to- moderate effect sizes in favor of the intervention group for attention, impulse control, cognitive flexibility, and social skills. However, these differences were not statistically significant. In contrast, findings related to working memory were particularly noteworthy, as the data demonstrated a large effect size in this domain. Additionally, the teachers reported that the progress observed in the intervention group during the autumn term was sustained through the end of the spring term. This finding suggests that the intervention may have enduring effects.

Overall, the positive outcomes of the study indicate that mindfulness-based practices may effectively support specific dimensions of executive function skills (Wood et al., 2018).

Another mindfulness-based program whose effects have been investigated is the Kindness Curriculum. However, findings from different studies examining the impact of this program on children have yielded inconsistent results. One study based on a mindfulness- and kindness-oriented training program suggested that the intervention may be effective in enhancing children's executive function skills, particularly impulse control and cognitive flexibility (Shlomov et al., 2023). In contrast, Jansen et al. (2024), using the same

program, reported improvements in children's social and emotional skills but found no significant gains in executive function abilities.

To better understand how mindfulness-based interventions influence different components of executive functions in preschool children, it is essential that such programs be more effectively designed and implemented to support child development.

In studies focusing on vulnerable populations—such as children from low-income families or those exhibiting lower baseline executive functioning—mindfulness programs appear to have an even more pronounced effect. Zelazo et al. (2018) reported broad improvements across executive domains for all participants, yet only the group receiving both mindfulness and reflection training maintained these gains during follow-up. Similarly, Lertladaluck et al. (2021) found significant improvements in working memory and impulse control in a Thai cohort of children with low executive function scores, though no notable changes were observed in cognitive flexibility.

Additionally, a study investigating the feasibility and effectiveness of a mindfulness-based yoga program for preschool children living in communities with high levels of trauma also assessed the program's impact on attention and self-regulation. Findings revealed that the program was both feasible and effective, resulting in significant improvements in children's attention regulation and self-regulation skills (Razza et al., 2019).

Most mindfulness-based intervention programs examined in the literature range from 6 to 12 weeks in duration; however, some studies have assessed the effects of short-term or even single-session interventions. One such study was conducted by Lim and Qu (2017), who investigated the impact of a 15-minute, single-session mindfulness training program—developed based on prior research—on attentional control in preschool children. The findings indicated that the mindfulness intervention reduced the tendency toward global information processing initially inclined toward holistic strategies, and similarly reduced local information processing in children with a detail-focused cognitive style. These results suggest that mindfulness practice may enhance the use of cognitive strategies to direct attention, although it does not appear to have a direct effect on attention itself.

Busch et al. (2023) conducted another study to evaluate the effects of a brief, 15-minute mindfulness-based yoga session. Based on teacher-reported data, children who participated in the program demonstrated improvements in social-emotional behavior and executive functioning, particularly in the domain of attention. Moreover, children in the intervention group showed greater increase in the number of correct responses on the cancellation task. These findings suggest that even a short mindfulness-based yoga session may positively influence behavioral regulation and attentional functioning in preschool-aged children.

Studies examining the neuroscientific effects of mindfulness-based interventions (Xie et al., 2022, 2024; Shlomov et al., 2023) have utilized EEG, fNIRS, and multi-scale sample entropy analysis methods. These studies have demonstrated that mindfulness-based programs can influence brain activity and enhance various components of executive functioning. The findings provide concrete evidence that mindfulness training produces not only behavioral outcomes but also measurable changes in brain activation.

To better understand and directly observe the effects of mindfulness-based programs, it is essential to place greater emphasis on studies that use EEG, fNIRS, and other neuroimaging techniques. Such research is particularly valuable in exploring the impact of mindfulness on brain activation and neurocognitive processes in a scientifically observable manner.

Some studies have also examined the role of mindfulness training in specific executive function domains—particularly attention and impulse control,—in relation to peer conflict in preschool children. For example, Caporaso (2017) implemented a mindfulness-based intervention alongside two cognitively demanding

educational programs. The findings revealed that mindfulness training did not lead to a statistically significant increase in children's use of more appropriate responses in peer conflict situations.

The findings of this research suggest that while mindfulness training may have the potential to enhance children's executive function skills, its effectiveness can vary depending on multiple factors and may not consistently yield significant results. These findings highlight the need for further longitudinal studies with larger sample sizes to better understand the impact of mindfulness-based interventions on the executive functioning of preschool children.

Moreover, some studies examining the effects of mindfulness practices on preschool children's developmental domains have explored the relationships between self-regulation and a various related outcomes. These include prosocial behavior, empathy, emotional awareness, peer interactions, perspective taking, social skills, and academic achievement.

Findings from studies evaluating the effects of mindfulness-based intervention programs on preschool children's self-regulation skills generally indicate that such interventions can support various self-regulatory abilities, including attention, delayed gratification, impulse control, and cognitive flexibility (Razza et al., 2015; Flook et al., 2015; Jackman et al., 2019; Li et al., 2019; Türkkent, 2023).

Yıldırım (2019) investigated the effects of a mindfulness-based yoga program on preschool children's self-regulation skills. The findings revealed that the children in the intervention group demonstrated higher performance in working memory; however, no significant differences were observed between the groups in other self-regulation domains. While teacher evaluations indicated no differences between the groups, mothers reported that the children in the intervention group exhibited higher levels of positive affect.

In a study conducted by Thierry et al. (2016), a mindfulness program designed to enhance children's self-regulation was implemented over the course of one year. The results indicated that the program led to improvements in executive functioning, particularly in working memory, planning, and organizational skills, whereas children in the control group showed declines in these same areas.

Similarly, Thierry et al. (2018) developed a mindfulness program focused on enhancing students' self-regulation and self-awareness through targeted activities. By the end of the academic year, students in the intervention group demonstrated greater improvements in executive functions than their peers in the control group who followed the standard curriculum. However, no significant differences were found between the groups in terms of prosocial behavior or academic achievement.

Research indicates that children who experience difficulties in self-regulation or who come from socioeconomically disadvantaged backgrounds may benefit more significantly from mindfulness-based interventions (Poehlmann-Tynan et al., 2016; Lemberger-Truelove et al., 2018). For example, Razza et al. (2015) found that children who participated in a mindfulness-based yoga program demonstrated significant improvements in their self-regulation skills, with the greatest gains observed among those identified as high-risk.

Similarly, Lemberger-Truelove et al. (2018) reported that the combination of social and emotional learning (SEL) and mindfulness practices led to notable improvements in task-focused attention and experiential engagement among children from disadvantaged communities.

Findings from several studies suggest that mindfulness-based programs may positively influence not only children's self-regulation skills but also their prosocial behaviors. For instance, Flook et al. (2015) concluded that the Kindness Curriculum significantly improved children's cognitive flexibility, delay in gratification, and prosocial behavior.

Expanding upon the work of Flook et al., Haines et al. (2023) investigated the effects of the Mindfulness-Based Kindness Curriculum (MBKC) on preschool children's social-emotional development, executive functioning, and academic performance. Their findings indicated that children in the intervention group scored significantly higher in all three areas than their peers in the control group.

Similarly, Berti and Cigala (2022) reported that a mindfulness-based intervention led to significant improvements in inhibitory control (a subdomain of self-regulation), perspective-taking, and prosocial behaviors among children.

Viglas (2015) examined the effects of a mindfulness-based intervention on preschool children's self-regulation, prosocial behaviors, and hyperactivity. These findings suggest that implementing mindfulness programs in early childhood classrooms can enhance self-regulation, promote prosocial behaviors, and reduce hyperactive behaviors.

Daşıran (2023) evaluated the impact of a “Holistic Mindfulness Training” program on preschool children's self-regulation and social skills. The results showed that children in the intervention group scored significantly higher than those in the control group on both the Self-Regulation Skills Scale (including its subdimensions) and Social Skills Assessment Scale.

However, some studies have shown that mindfulness-based interventions do not always produce consistent or statistically significant results. For example, in a study conducted by Torres (2019) examining the effects of a mindfulness-based social skills program, no significant differences were found in children's self-regulation or prosocial behavior skills. Similarly, Stanley (2018) reported that mindfulness-based intervention did not result in notable improvements in children's self-regulation abilities. These findings suggest that the effectiveness of mindfulness interventions may vary depending on several factors, including the individual characteristics of the child, the duration of the program, and the method of implementation. Research involving older children has produced mixed outcomes regarding the efficacy of mindfulness interventions. A recent study conducted in Canada examined the impact of dispositional mindfulness (i.e., children's natural tendency or trait-level inclination toward mindfulness) on the mental health development of elementary school children, as well as whether a mindfulness-based intervention moderated this effect. It was found that higher levels of dispositional mindfulness were associated with reduced symptoms of inattention, anxiety, and depression; however, the intervention did not significantly strengthen this relationship. The findings suggest that while dispositional mindfulness is beneficial, it may need to be supported by additional emotion regulation techniques in order to achieve optimal outcomes (Malboeuf-Hurtubise et al., 2025).

Some studies of mindfulness-based interventions have included follow-up assessments to evaluate the long-term effects of these programs. For instance, Pashlı and Temel (2024) found that the effects of a mindfulness-based intervention persisted beyond the post-test period. Similarly, Türkkent (2023) reported that an eight-week mindfulness-based social-emotional learning program yielded statistically significant long-term improvements in children's self-regulation skills.

Yurdakul (2025) investigated the impact of an eight-week mindfulness program tailored for preschoolers aged 60 to 72 months using a single-group experimental approach. The study reported notable gains in attention and working memory among participants, although inhibitory control did not show measurable improvement. These outcomes suggest that when designed with developmental appropriateness, mindfulness-based programs in early childhood can enhance specific dimensions of self-regulation.

Various studies have examined the effects of mindfulness-based social-emotional learning programs on preschool children's psychosocial adjustment and neuropsychological development. One such program, OpenMind-Korea (OM-K), was evaluated by Kim et al. (2020), who reported improvements in children's emotion regulation, psychological resilience, and prosocial behaviors.

Similarly, Moreno-Gómez and Cejudo (2019), found that the MindKinder program supported children's psychosocial adaptation and contributed to their neuropsychological development, including improvements in motor skills, pronunciation, language comprehension, expressive language, spatial structuring, visual perception, memory, and rhythm skills. In a subsequent study implementing the same program, children demonstrated significant improvements in school adjustment, behavioral problems, and academic achievement (Moreno-Gómez, et al., 2020).

Additionally, Berger et al. (2024) investigated the effects of a mindfulness intervention and found that participants in the intervention group showed decreased impulsivity, increased sustained attention, greater attention toward the teacher, and reductions in social difficulties and aggression.

In a study conducted by Aydın and Özbey (2023), the impact of a Mindfulness Education Program on preschool children's emotional intelligence was examined. The findings revealed a statistically significant difference in favor of the intervention group compared with the control group. Similarly, Bazzano et al. (2023) reported that school-based yoga and mindfulness programs played a supportive role in enhancing young children's social-emotional competencies and psychological resilience. In another study, Erten and Güneş (2024) investigated the effects of mindfulness practice during early childhood on social behavior. Their findings showed an increase in positive social behaviors and decrease in behaviors associated with physical aggression and depressive symptoms.

The effects of mindfulness practices on emotion regulation and mental health have been widely studied not only during early childhood but also among primary school children and adults. Research involving 259 adolescents aged 8 to 12 has highlighted the potential of mindfulness and emotional regulation training as a protective mechanism against mental health challenges in early adolescence (Porter et al., 2025). A digital mindfulness training program known as ISSMT, built upon the MAT framework, was implemented in China via the "Hi Emotion" platform to target depressive symptoms in adults (Zhu et al., 2025). Participants aged 18 and older were randomly allocated to either the intervention or control group. The intervention group engaged in brief daily sessions over a two-week period, supported by automated reminders. Changes in mindfulness levels and depressive symptoms were monitored weekly, and the results suggested that the program enhanced mindfulness while reducing symptoms of depression.

Garrison (2017), designed a self-compassion and mindfulness program for preschool children and evaluated its feasibility and potential effects. The program was intended to enhance emotional resilience, social-emotional well-being, and other factors associated with school readiness through self-compassion and mindfulness practices. The findings indicated that introducing preschool children to self-compassion and mindfulness practices yielded positive outcomes and demonstrated the practical applicability of such interventions in this age group. The study further showed that the intervention was effective in reducing behavioral and emotional difficulties, with notable improvements observed in emotional reactivity, aggression, withdrawal, attention problems, and sleep disturbances. In a related study, Dorra and Jarraya (2024) investigated the effects of a short-term mindfulness intervention delivered Daily for 30 minutes over five consecutive days. Their findings suggested that such an intervention may positively influence motor skills and social behaviors, although it did not yield a statistically significant effect on psychological resilience.

Some studies have reported inconclusive or mixed findings regarding the effects of mindfulness-based programs. For example, Li-Grining et al. (2021) observed that the CaLM program, developed for children from low socio-economic backgrounds, had positive effects on children's overall well-being and self-regulation skills; however, these differences were not statistically significant. In another study, Yaari et al. (2019) found that the *Early Minds* program received positive feedback from both educators and parents in Australia. Nevertheless, they emphasized the need for further research to establish the generalizability of

the program's outcomes. Similarly, Sexton et al. (2022) evaluated the *Early Minds* program in terms of its effects on children's internalizing and externalizing behaviors, prosocial skills, and executive functions. Although this study aimed to assess program effectiveness, several limitations related to its feasibility and implementation were identified.

Mindfulness-based interventions have also been shown to positively impact children's relationships with peers, teachers, and parents. For example, Courbet et al. (2024) found that the French adaptation of the Kindness Curriculum reduced both teacher-child and peer-child conflicts, while also contributing positively to children's mental health. Similarly, in a study conducted by Crooks et al. (2020), the *MindUP* program was found to reduce children's negative behaviors, enhance their adaptive functioning, and improve executive functions. In this context, providing mindfulness training for teachers and integrating mindfulness practices into the curriculum in a sustainable manner may strengthen children's social relationships and foster a developmentally supportive environment.

In a study examining the effects of an intervention program integrating mindfulness practices with unstructured free play activities, the intervention was implemented over five consecutive days. The findings indicated that children who participated in outdoor free play combined with brief mindfulness sessions showed improvement in both play skills and emotional well-being. However, no significant differences were found between the groups in terms of physical activity levels or peer interactions. One notable result was that happiness scores significantly increased in the intervention group, whereas no change was observed in the control group (Lee, et al. 2020).

In another study, Malboeuf-Hurtubise et al. (2020) examined the effects of a combined philosophy (P4C – Philosophy for Children) and mindfulness-based intervention program for preschool children on both positive and negative indicators of mental health. The results showed that there were generally no statistically significant differences in the mental health indicators between the experimental and control groups. These findings suggest that the short-term effects of a combined mindfulness and philosophy-based intervention on children's mental health are limited.

In a study conducted by Çollak (2018), the effects of an eight-week mindfulness program for preschool children were examined in terms of various skill areas, including attention/focus, calmness, self-control, self-acceptance and self-love, as well as being caring and helpful toward others. The findings revealed significant improvements in each of these skills among participating children.

Özcan (2024) investigated the impact of a school-based mindfulness program on children's school readiness. The results indicated that the program had a positive effect on school readiness and that these effects were sustained over a four-week period based on according to follow-up assessments.

Overall, the research findings suggest that mindfulness-based intervention programs have the potential to enhance preschool children's self-regulation and social-emotional skills. However, inconsistencies have been observed across studies owing to factors such as program duration and participant characteristics. Therefore, future research should aim to include larger sample sizes, evaluate long-term retention effects, and conduct more precise and detailed analyses of program feasibility. Such efforts would contribute to obtaining more robust and generalizable results.

Several studies have explored the integration of mindfulness practices with art-based activities. For instance, Wong et al. (2024) investigated the effects of a mindfulness-based mandala intervention on children's attention and social-emotional development. The findings revealed that the children in the intervention group demonstrated improvements in five thematic areas: increased attention, emotional awareness, emotion validation, emotion regulation, and recognition of interpersonal relationships.

The reviewed studies, also investigated the effects of mindfulness-based intervention programs on eating-related issues. For example, Dial et al. (2020) evaluated whether a mindfulness-based intervention was effective in reducing food neophobia. They found that mindfulness-based eating exercises supported children in using more of their senses and identifying foods during the process of exploring new foods. However, no statistically significant difference was observed in the actual willingness to try new foods. The researchers concluded that while mindfulness-based eating exercises may facilitate food exploration, they may not be sufficient on their own to reduce food neophobia.

Similarly, Brann et al. (2024) examined the effects of mindfulness practices on executive functions and eating behaviors. The findings revealed improvements in children's executive function skills, such as attention, planning, and self-control. In addition, the children demonstrated more regulated eating behaviors and made healthier food choices. These results suggest that mindfulness practices during early childhood may be effective not only in enhancing cognitive skills but also in promoting healthy eating habits.

Conclusions and Recommendations

This systematic review reveals several important indicators regarding mindfulness-based studies conducted with preschool-aged children. An examination of studies published between 2015 and 2025 shows that international journal articles were the most frequently published type of research, with a notable increase observed in the years 2018 and 2024. In terms of country-based distribution, the United States stands out as the leading contributor to mindfulness research involving preschool children. Regarding the duration of intervention programs, the majority of studies implemented eight-week interventions. The longest program lasted one year, whereas the shortest involved a single 15-minute session. In terms of participant age distribution, the 3–5-year-old age group was the most frequently studied.

Findings related to the impact areas of mindfulness-based interventions applied during the preschool period suggest positive outcomes on children's executive functioning, self-regulation, social-emotional development, psychological resilience, and overall well-being. Specifically, significant improvements were noted in executive function components such as attention, impulse control, working memory, and cognitive flexibility. In addition, social-emotional skills such as empathy, prosocial behavior, and emotional awareness were found to be positively supported. However, the absence of statistically significant findings in some studies suggests that such effects may vary depending on contextual and individual factors such as program content, duration, and sample size.

Based on the findings presented above, several key recommendations can be outlined.

1. **Standardized Intervention Programs:** Given the challenges in comparing the effectiveness of programs with varying content, it is recommended that mindfulness interventions be structured according to shared standards (e.g., duration, content, and developmental appropriateness) and systematically evaluated for their applicability.
2. **Longitudinal and Large-Scale Studies:** To assess the long-term effectiveness and generalizability of intervention programs, future research should include longer-term studies with larger sample sizes.
3. **Neuroimaging-Supported Data:** In order to evaluate the neurocognitive impacts of mindfulness-based interventions more concretely, studies employing neuroimaging techniques such as EEG and fNIRS should be encouraged.
4. **Programs Targeting Disadvantaged Groups:** Since children from socioeconomically disadvantaged or high-risk backgrounds appear to benefit more from mindfulness interventions, greater emphasis should be placed on programs designed for these populations.

5. **Integration with Art, Play, and Nutrition:** Programs that integrate mindfulness with art, music, mandala, free play, or healthy eating habits may enhance the positive effects on children's behaviors and skills, and therefore should be promoted.

6. **Educators' Mindfulness Experiences:** Mindfulness practices can be implemented both directly and indirectly in preschool settings. Indirect implementation involves teachers' own knowledge and experience of mindfulness. To increase the success of such programs, it is recommended to expand mindfulness-based training programs for educators.

In conclusion, mindfulness-based practices have significant potential to support developmental domains in preschool-aged children. However, methodologically rigorous research is needed to establish these effects more clearly and reliably.

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Table III : Studies Included in the Study

Citation Code	Publication Type	Author	Year	Country	Age	Publication Title
A1	Article	Aydın, Ayşe and Öz-bey, Saide	2022	Türkiye	5-6 year	Investigation of the effect of mindfulness-based education programme on the executive function levels of preschool children.
A2	Article	Aydın, Ayşe and Öz-bey, Saide	2023	Türkiye	5-6 year	Investigation of the effect of mindfulness training programme on emotional intelligence levels of preschool children.
A3	Article	Bazzano, Alessandra N, Sun, Yaoyao, Zu, Yuanhao, Fleckman, Julia M, Blackson, Emma A, Patel, Tejal, Shorty-Belisle, Angie, Liederman, Keith H and Roi, Cody	2023	USA	3-5 year	Yoga And Mindfulness For Social-Emotional Development And Resilience In 3–5 Year-Old Children: Non-Randomized, Controlled Intervention
A4	Article	Berger, Rony, Benatov, Joy, Karna, Ankita, Wu, Rui, Tarrasch, Ricardo, van Schaik, Saskia DM and Brennick, Alaina	2024	Israel	5 year	Cultivating Compassion In Jewish-Israeli Kindergartners: The Effectiveness Of Mindfulness-And Empathy-Based Interventions As Facilitators Of Compassion
A40	Article	Berti, S., & Cigala, A	2022	Italy	3-6 year	Mindfulness For Preschoolers: Effects On Prosocial Behavior, Self-Regulation And Perspective Taking.
A5	Article	Brann, Lynn S, Razza, Rachel A and Smith, Caitlin S	2024	USA	3-5 year	The Feasibility And Preliminary Effectiveness Of A Mindfulness Intervention On Preschooler’S Executive Function And Eating Behaviors
A6	Article	Busch, Andrew M, Modica, Christopher A and Sheridan, Emily R	2023	USA	4-6 year	The Effect Of Yoga On Anxiety, Attention And Social-Emotional Symptoms In Preschool Children: A Pilot Quasi-Experimental Study

T11	Thesis	Caporaso, J. S	2017	USA	5 year	The Use Of Mindfulness Training To Examine The Role Of Executive Function İn Pre-school Peer Conflict.
A7	Article	Courbet, Ophélie, Daviot, Q, Kalamarides, Victoire, Habib, Marianne, Castillo, MC C and Villemonteix, Thomas	2024	France	3-5 year	Promoting Psychological Well-Being İn Preschool Children: Study Protocol For A Randomized Controlled Trial Of A Mindfulness-And Yoga-Based Socio-Emotional Learning Intervention
A8	Article	Crooks, Claire V, Bax, Karen, Delaney, Andrea, Kim, Haesoo and Shokoohi, Mostafa	2020	Kanada	4-6 year	Impact Of Mindup Among Young Children: Improvements İn Behavioral Problems, Adaptive Skills, And Executive Functioning
T1	Thesis	Çollak, Nisa	2018	Türkiye	5-6 year	8-week mindfulness programme for preschool children and the effects of the programme on children
T2	Thesis	Daşıran, Tuba Yeşilay	2023	Türkiye	4-6 year	Examination of the effect of holistic awareness training on the self-regulation and social skills of preschool children
A9	Article	Dial, Lauren A, Emley, Elizabeth, Koerten, Hannah R, Waite, Tabitha C and Musher-Eizenman, Dara R	2020	USA	3- 5 year	A Mindfulness İntervention For Food Neophobia Among Preschoolers
A10	Article	Dorra, Jalleli and Jarraya, Sana	2024	Tunisia	4-5 year	The Effect Of A Short-Term Mindfulness Program On Motor Skills And On Psychological And Social Behavior İn Preschool Children: A Randomized Controlled Trial.
A12	Article	Erten, Ceren and Güneş, Gökhan	2024	Türkiye	5-6 year	Social Behaviour Changes Via Mindfulness Practices İn Early Childhood
A13	Article	Flook, Lisa, Goldberg, Simon B, Pinger, Laura and Davidson, Richard J	2015	USA	4 year	Promoting Prosocial Behavior And Self-Regulatory Skills İn Preschool Children Through A Mindfulness-Based Kindness Curriculum

T3	Thesis	Garrison, Jillian LeRae	2017	USA	3-5 year	A Self-Compassion And Mindfulness Program For Preschoolers
A14	Article	Haines, Beth A, Hong, Phan Y, Immel, Kathy R and Lishner, David A	2023	USA	3-5 year	The Mindfulness-Based Kindness Curriculum For Preschoolers: An Applied Multi-Site Randomized Control Trial
A15	Article	Jackman, Monica M, Nabors, Laura A, McPherson, Carrie L, Quaid, Jill D and Singh, Nirbhay N	2019	USA	3-5 year	Feasibility, Acceptability, And Preliminary Effectiveness Of The Openmind (Om) Program For Pre-School Children
A16	Article	Jansen, Petra, Siebertz, Markus and Portele, Christiane	2024	Germany	3-6 year	A Kind Mind: Enhancing Socio-Emotional Skills In German Preschool Children Through The Mindfulness-Based Kindness Curriculum
A17	Article	Kim, Eunjin, Jackman, Monica M, Jo, Seong-Hun, Oh, Jisun, Ko, Shi-Yong, McPherson, Carrie L, Hwang, Yoon-Suk and Singh, Nirbhay N	2020	Korea	3 year	Effectiveness Of The Mindfulness-Based Openmind-Korea (Om-K) Preschool Program
A18	Article	Lee, Regina Lai Tong, Lane, Shelly Jerrine, Tang, Anson Chiu Yan, Leung, Cynthia, Kwok, Stephen Wai Hang, Louie, Lobo Hung Tak, Browne, Graeme and Chan, Sally Wai Chi	2020	China	4-6 year	Effects Of An Unstructured Free Play And Mindfulness Intervention On Wellbeing In Kindergarten Students
A19	Article	Lemberger-Truelove, Matthew E, Carbonneau, Kira J, Atencio, David J, Zieher, Almut K and Palacios, Alfredo F	2018	USA	3-4 year	Self-Regulatory Growth Effects For Young Children Participating In A Combined Social And Emotional Learning And Mindfulness-Based Intervention
A20	Article	Lertladaluck, Kanda, Suppalarkbunlue, Warabud, Moriguchi, Yusuke and Chutabhakdikul, Nuanchan	2021	Thailand	4-5 year	School-Based Mindfulness Intervention Improves Executive Functions And Self-Regulation In Preschoolers At Risk

A21	Article	Li, Quan, Song, Yanan, Lian, Bin and Feng, Tingyong	2019	China	3-4 year	Mindfulness Training Can Improve 3-And 4-Year-Old Children'S Attention And Executive Function
A22	Article	Li-Grining, Christine Pajunar, Vera, Elizabeth, Janusek, Linda, Saban, Karen, Liston, Yarina, Naqi, Zahra and Troske, Mackenzie	2021	USA	4 year	Exploring The Possible Emergence Of Prosocial And Relational Leadership Capacity In A Mindfulness-Based Transitional Kindergarten Classroom: A Phenomenological And Exploratory-Based Qualitative Case Study
A23	Article	Lim, Xinyi and Qu, Li	2017	Singapore	4- 6 year	The Effect Of Single-Session Mindfulness Training On Preschool Children'S Attentional Control
A24	Article	Malboeuf-Hurtubise, Catherine, Lefrançois, David, Mageau, Geneviève A, Taylor, Geneviève, Éthier, Marc-André, Gagnon, Mathieu and DiTomaso, Carina	2020	Kanada	4-5 year	Impact Of A Combined Philosophy And Mindfulness Intervention On Positive And Negative Indicators Of Mental Health Among Pre-Kindergarten Children: Results From A Pilot And Feasibility Study
A11	Article	Moreno-Gómez, A. J., & Cejudo, J.	2019	Spain	4-6 year	Effectiveness Of A Mindfulness-Based Social-Emotional Learning Program On Psychosocial Adjustment And Neuropsychological Maturity In Kindergarten Children.
A25	Article	Moreno-Gómez, Alfonso, Luna, Pablo and Cejudo, Javier	2020	Spain	5-6 year	Promoting School Success Through Mindfulness-Based Interventions In Early Childhood
T4	Thesis	Önoğlu Yıldırım, Eda	2019	Türkiye	3-5 year	The Effects Of Mindfulness Based Yoga Intervention On Preschoolers' Self-Regulation Ability
T7	Thesis	Özcan M,	2024	Türkiye	4-6 year	The effect of school-based mindfulness programme on school readiness of children aged 48-72 months / Impact of school-based mindfulness programme on school readiness of children aged 48-72 months.

A26	Article	Paslı, Hatice and Temel, Fulya	2024	Türkiye	5-6 year	The effect of mindfulness practices on children's self-regulation skills according to teacher evaluations.
A27	Article	Poehlmann-Tynan, Julie, Vigna, Abra B, Weymouth, Lindsay A, Gerstein, Emily D, Burnson, Cynthia, Zabransky, Matthew, Lee, Pilline and Zahn-Waxler, Carolyn	2016	USA	3-5 year	A Pilot Study Of Contemplative Practices With Economically Disadvantaged Preschoolers: Children'S Empathic And Self-Regulatory Behaviors
T5	Thesis	Rajbhandari, Biju	2023	USA	4-5 year	Mindfulness Practice Relates To Improvements İn Delaying Gratification İn Preschoolers
A28	Article	Razza, Rachel A, Bergen-Cico, Dessa and Raymond, Kimberly	2015	USA	3-5 year	Enhancing Preschoolers' Self-Regulation Via Mindful Yoga
A29	Article	Razza, Rachel A, Linsner, Rachel Uveges, Bergen-Cico, Dessa, Carlson, Emily and Reid, Staceyann	2020	USA	3-5 year	The Feasibility And Effectiveness Of Mindful Yoga For Preschoolers Exposed To High Levels Of Trauma
A30	Article	Sexton, Ella TS, Sheehan, Jane, Van Dam, Nicholas T, Grobler, Anneke, Phillips, Lisa, Yaari, Maya and Hiscock, Harriet	2022	Australia	3-4 year	Feasibility Of The Early Minds Program By Smiling Mind: A Pilot Cluster-Randomized-Controlled Trial
A31	Article	Shlomov, Ilana, Levit-Binnun, Nava and Horowitz-Kraus, Tzipi	2023	Israel	4-6 year	Neurodevelopmental Effects Of A Mindfulness And Kindness Curriculum On Executive Functions İn Preschool Children—A Randomized, Active-Controlled Study
T6	Thesis	Stanley, Oceann C.	2018	USA	3-5 year	Mindfulness Meditation And Personality Effects On Self-Regulation İn Preschoolers

A32	Article	Thierry, Karen L, Bryant, Heather L, Nobles, Sandra Speegle and Norris, Karen S	2016	USA	4 year	Two-Year Impact Of A Mindfulness-Based Program On Preschoolers' Self-Regulation And Academic Performance
A33	Article	Thierry, Karen L, Vincent, Rhonda L, Bryant, Heather L, Kinder, Michelle B and Wise, Christina L	2018	USA	4 year	A Self-Oriented Mindfulness-Based Curriculum Improves Prekindergarten Students' Executive Functions
T8	Thesis	Torres, Remi Alyssa	2019	USA	3-5 year	The Impact Of A Preschool Mindfulness Program On Children'S Self-Regulation And Prosocial Skills
T9	Thesis	Türkkent, A.	2023	Türkiye	5-6 year	The effect of mindfulness-based social emotional learning programme on preschool children's self-regulation skills
T10	Thesis	Viglas, Melanie	2015	Kanada	4-6 year	Benefits Of A Mindfulness-Based Program In Early Childhood Classrooms
A34	Article	Wong, Waisan, Zhang, Donghang, Hu, Jierong and U, Chao	2024	China	5-6 year	Improving Emotional And Social Development In Preschool Children: Exploring The Effects Of Mindfulness-Based Mandala Intervention In Social Work Practice In Macao
A35	Article	Wood, Laura, Roach, Andrew T, Kearney, Moriah A and Zabek, Faith	2018	USA	3-5 year	Enhancing Executive Function Skills In Preschoolers Through A Mindfulness-Based Intervention: A Randomized, Controlled Pilot Study
A36	Article	Xie, Sha, Gong, Chaohui, Lu, Jiahao, Li, Hui, Wu, Dandan, Chi, Xinli and Chang, Chunqi	2022	China	5-6 year	Enhancing Chinese Preschoolers' Executive Function Via Mindfulness Training: An Fnrirs Study
A37	Article	Xie, Sha, Lu, Shuqi, Lu, Jiahao, Gong, Chaohui and Chang, Chunqi	2024	China	3-6 year	Using Mindfulness-Based Intervention To Promote Executive Function In Young Children: A Multivariable And Multiscale Sample Entropy Study

A38	Article	Yaari, Maya, Sheehan, Jane, Oberklaid, Frank and Hiscock, Harriet	2019	Australia	3-4 year	Early Minds: A Pilot Randomised Controlled Trial Of A Mindfulness Program In Early Learning Centres
A39	Article	Zelazo, Philip David, Forston, Jessica L, Masten, Ann S and Carlson, Stephanie	2018	USA	4-5 year	Mindfulness Plus Reflection Training: Effects On Executive Function In Early Childhood

ARTICLES FOR FACULTY MEMBERS



CHILDREN'S SOCIOEMOTIONAL SKILLS

Changing the dynamics of preschool children's social play with technology: Evaluation of technology-based supports for tools of the mind style play / Diederich, K., Currin, F. H., Blasi, K., Schmidt, A. D., David, H., Peterman, K., & Hourcade, J. P.

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Changing the dynamics of preschool children's social play with technology: evaluation of technology-based supports for tools of the mind style play

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ABSTRACT

In the context of a pandemic that has had wide-ranging negative impacts on preschool children's socioemotional development it is important to consider uses of technology to support children re-engaging socially with peers. In this article, we review the landscape of systems to support children's face-to-face collaboration and identify an underexplored approach that could be well suited for the current context: using technology in a peripheral role to support activities where the focus is on other children and non-electronic objects and where children are free to engage with the physical space around them with the support of adults. We then present a pre-pandemic evaluation of *StoryCarnival*, a system with these underexplored characteristics, designed to support preschool children's sociodramatic play, for which there is evidence of numerous benefits that can positively impact children's socioemotional development. The results of the evaluation comparing sociodramatic play with and without *StoryCarnival's* support suggest that while not being the focus of the activity, *StoryCarnival's* components changed the dynamics of play for the children in the study during our observations, such that children displayed more mature play characteristics. Our discussion includes implications for child-computer interaction and considerations for the pandemic context.

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1. Introduction

The great disruptions brought to children and their families by the COVID-19 pandemic have had a negative impact on many children's socioemotional development, with consistent reports of stress, anxiety and depression, as noted in systematic reviews (Meherali et al. 2021; Panda et al. 2021), and a wide range of studies and reports from all over the world (Adegboye et al. 2021; Ares et al. 2021; Barnett, Grafwallner, and Weisenfeld 2021; Bentenuto et al. 2021; Cacioppo et al. 2021; Cost et al. 2022; Davico et al. 2021; Davidson et al. 2021; de Figueiredo et al. 2021; Egan et al. 2021; Hefferon et al. 2021; Luijten et al. 2021; Orgilés et al. 2021; O'Sullivan et al. 2021; Ravens-Sieberer et al. 2022, 2023; Tokatly Latzer, Leitner, and Karnieli-Miller 2021). For example, a German study surveying 1,923 children (7–17 years old) found about two-thirds were experiencing decreased quality of life and higher anxiety levels both in May/June 2020 (Ravens-Sieberer et al. 2022) and December 2020/January 2021 (Ravens-Sieberer et al. 2023). A survey of 2,419 Italian parents of 8–18-year-old children found that close to a third of children were at high risk for post-traumatic stress

disorder (Davico et al. 2021). Studies focusing on younger children (Barnett, Grafwallner, and Weisenfeld 2021; Davidson et al. 2021; Egan et al. 2021) found similar concerns with themes of social isolation, stress and anxiety. These negative consequences add to already worrying pre-pandemic trends of increasing mental health crises among adolescents in the United States (Kalb et al. 2019). Given the strong evidence of social anxiety (Fox et al. 2005) during early childhood as a predictor of anxiety disorders later in childhood (Penela et al. 2015; Smith et al. 2019) and adulthood (Sandstrom, Uher, and Pavlova 2020; Zeytinoglu et al. 2021), we suggest that greater efforts should be made to help children re-engage socially in preschools, in particular with activities that may be protective of their socioemotional development.

This article centres around research on a system called *StoryCarnival* (Currin et al. 2021; Pantoja et al. 2017, 2019) that although developed prior to the pandemic, we believe has the necessary foundational components to contribute to addressing this urgent need. Pantoja et al. (Currin et al. 2021; Pantoja et al. 2017, 2019) designed *StoryCarnival* to lower barriers to an

evidence-based practice, sociodramatic play in the style of the *Tools of the Mind* (ToM) approach to early childhood education (Bodrova and Leong 2007). In this approach, the goal is for children to participate in ‘mature play’, which is defined by the characteristics listed in Table 1. Researchers have conducted multiple large studies identifying the positive short and long-term impact of this type of play, including enhanced executive function (EF) and academic achievement (Blair and Raver 2014, 2015; Diamond et al. 2007; Diamond and Lee 2011; Mottweiler and Taylor 2014). Prior to the pandemic, other researchers had already linked EF deficits with anxiety (Lawson et al. 2015; Penela et al. 2015; Smith et al. 2019; Zainal and Newman 2018), making it unsurprising that a study found negative behavioural impacts of the pandemic on young adults with lower EF (Appelhans et al. 2021). Pandemic-era studies also found play and social integration with other children and family members to be a protective factor (Egan et al. 2021; Tokatly Latzer, Leitner, and Karnieli-Miller 2021) and something children desired (Pascal and Bertram 2021). *StoryCarnival* aims to support an evidence-based practice that by enhancing EF and engaging children in social play has the potential to reduce harm for children at risk of having negative impacts in their socioemotional development.

The current version of *StoryCarnival* consists of an app with interactive stories to introduce children to characters of equal importance and story settings on which to base play, a play-planning tool and a facilitator-controlled (through speech suggestions and free text entry), tangible voice agent to engage the children during play (Currin et al. 2021). *StoryCarnival* supports social play activities where the focus is on symbolic play with non-electronic props, other children and the physical environment, with the ability for children to move around as they please, and technology in a supportive role, controlled by adult facilitators, aiming to inspire and sustain creative social play as inclusively as possible.

Table 1. Characteristics of mature play for Tools of the Mind approach to early childhood education (Bodrova and Leong 2007).

1	Act out scenes within a pretend scenario instead of repeating actions.
2	Use props symbolically instead of using objects only realistically.
3	Play roles with specific characteristics instead of not playing within roles.
4	Use oral language to describe what they are doing with respect to play instead of minimal language.
5	Coordinate play with multiple roles instead of engaging in parallel play.
6	Discuss with each other what they are going to do next, as opposed to just doing it.
7	Solve disputes by inventing new roles for props instead of fighting over props.
8	Can continue play from prior sessions instead of only being able to engage in play for 5–10 min.

We believe this approach to using technology to support evidence-based practices will not only be beneficial to children, but also more acceptable to parents and teachers than screen-based activities (Auxier et al. 2020) or smart toys that gather data and process it remotely (McStay and Rosner 2021).

There are three reasons why we are using technology to support ToM-style play and why similar approaches could be pursued for similar evidence-based activities. The first is that successful implementations of ToM have required significant staff training and coaching (Blair and Raver 2014), which is unlikely to be practical for most preschools. This is not an unusual barrier for evidence-based practices directed at young children (Foster 2022). *StoryCarnival* was designed to lower barriers to ToM-style play. The second is that technology could change the dynamics of these activities in ways that could provide benefits, such as, more mature play. The third is that because of the prevalence of technology use by children and concerns that this use might contribute to children’s social isolation (Turkle 2011), we as human–computer interaction researchers have a responsibility to investigate whether other applications of technology may instead foster beneficial social engagement.

This article makes contributions with respect to the second and third reasons for using technology. First, if we are to consider technology to support face-to-face social activities for children, it is useful to understand the landscape of approaches to support face-to-face collaboration with technology. Our first contribution is a thorough survey of research from two key conferences where child-computer interaction research is published on technologies involving face-to-face activities. The survey reveals an underexplored space for technologies that support children’s face-to-face activities, but that are not the centre of attention of these activities, enabling children to focus on each other and on non-electronic objects, free to move around and interact with the physical space around them. This underexplored space, with technology on the periphery, supporting an evidence-based activity, is where *StoryCarnival* fits. The second contribution is an in-depth analysis of an 8-week pre-pandemic comparison of 3–5-year-old children participating in ToM-style play with and without *StoryCarnival*. Through this analysis, we investigate *StoryCarnival*’s impact on the maturity of children’s sociodramatic play including children’s play coordination, the role of adult facilitators, and how children related to *StoryCarnival*’s voice agent. Altogether, we provide examples of how *StoryCarnival* facilitated changes in the dynamics of children’s play during our observations. For example, we

found evidence of more coordinated play and more centrality to children's roles when using *StoryCarnival*, compared to when children played without technology supports. We also noted the variety of ways in which children interacted with *StoryCarnival's* facilitator-controlled voice agent that were different from how they interacted with facilitators. We expect that this contribution will motivate the exploration of novel uses of technology to manage the dynamics of children's face-to-face play such that it can be tuned to help children re-engage in social activities.

2. Survey of support for face-to-face collaboration in the child-computer interaction literature

If we are to consider the role of technologies in children's face-to-face activities, it is useful to understand the range of approaches that researchers have considered for supporting such activities. Researchers in child-computer interaction have long sought to go beyond computer experiences that involve one child and one device, designing systems that enable multiple children to work together face-to-face (e.g. Druin et al. 1997). There is also a broad literature on technologies supporting children's remote collaboration and communication, but that is outside the scope of this article. To get a better sense for the range of approaches for technologies to support children's face-to-face collaboration in the literature, we identified relevant publications from both the ACM Interaction Design and Children (IDC) conference and the ACM Conference on Human Factors in Computing Systems (CHI), two key conferences for research on child-computer interaction. This survey of conference publications is similar to others recently published at the IDC conference (Kawas et al. 2020; Van Mechelen et al. 2020).

2.1. Method for identifying relevant literature

We identified relevant works using Google Scholar and key words: face-to-face, collaboration, co-located, multi-user, social, computer-supported cooperative work (CSCW) and tangible. We searched for publications in two venues: the Interaction Design and Children (IDC) conference and the Human Factors in Computing Systems (CHI) conference. Our search included all articles published in these two venues between 1990 and 2020 (note that IDC did not start until 2002). The search for IDC and CHI publications identified 558 and 849 potential works respectively, which contained at least one of the relevant keywords for further analysis.

To arrive at a relevant set of publications, at least two researchers reviewed each publication and identified those that were full papers and described a system for use with children under the age of 18 to support co-located, face-to-face activities. Because of the emphasis on face-to-face communication, we did not include works supporting remote collaboration. To be considered a face-to-face collaboration system, the actions of any child within the course of the activity could not be completely independent of all other participants. For example, children independently using the same software in computer lab setting would not meet our selection criteria. For this reason, we excluded systems that supported multiple users within a shared space acting independently of each other. For cases where there were disagreements on whether to include a publication, the two researchers discussed the publication and, if necessary, discussed it with other members of the research team. As a result of this process, we identified 52 relevant publications from IDC and 29 from CHI. A list of the papers is in Appendix A.

Following the selection process, we analysed the 81 papers using an open coding methodology (Onwuegbuzie, Frels, and Hwang 2016) to identify areas of commonality, focusing specifically on the design of the technology supporting collaboration. We examined methods used by participants to interact with both the system and the surrounding environment, the extent (or role) to which adults were involved within the collaboration as part of the system, the proximity of the users within the activity for which the collaboration system was used, and the amount of attention devoted to the technology within the scope of the collaboration as part of the interaction with the system.

As we reviewed the articles, we noticed different approaches to supporting face-to-face activities and developed a categorisation scheme to better understand the variety of approaches used, and the areas that are underexplored and that could potentially benefit children given the current context. The categories we coded for were the following:

Adult Involvement: Role of adults in the activity supported by the system (e.g. no involvement vs. active participation).

User Motion: Range of user motion related to the face-to-face activity (e.g. sitting at a desk vs. moving freely around a room).

Attention to Technology: Amount of focus devoted to technology (e.g. full attention vs. casual awareness).

Interactions with the Physical Environment: User interaction with the physical environment other than the system (e.g. interactions with non-electronic toys).

Three researchers separately coded seven papers based on the categorisation scheme on a five-point scale. Following the independent classification, the researchers met to clarify any disagreements. A single researcher classified the remaining 74 papers. To demonstrate the consistency of the coding scheme, an inter-rater reliability analysis was conducted by having two different researchers independently code 9 randomly selected papers from the set of 74 paper coded by a single researcher. The Cohen's Kappa value of agreement between the coders was 0.740 (for the 108 codes assigned to 9 papers), which is classified as substantial agreement.

2.2. Survey results

Below, we focus on cross-tabulations of the results to show combinations of characteristics that are prevalent and those that could be further explored. To simplify all following graphs we use the scale: -2 (Sparse), -1, 0 (Balanced), 1, 2 (Considerable). We mark *StoryCarnival* on each graph with a red 'X'.

When we examined the relationship between Adult Involvement and User Motion, there were few examples of systems that incorporated both considerable user motion and considerable adult involvement (see Figure 1). Systems with higher user motion tended to have low adult involvement, and vice versa. *MOGCLASS*, a system where a group of co-located children make music together using mobile devices with a high level of involvement from teachers, is an example of a system with low child motion and high adult involvement (Zhou et al. 2011). The *TagTiles* system involves children jumping up and down to generate energy necessary to play a game, requiring high levels of user motion, but little adult involvement (Zhang, Shrubsole, and Janse

2010). The *pOwerball* mixed-reality game is an example of a system with low user motion and low adult involvement, featuring support for 2–4 child players on an augmented reality tabletop upon which the game's animations are projected (Brederode et al. 2005).

StoryCarnival is one of a handful of systems that support children's ability to explore the physical space around them while having a high level of adult support. Such approaches may be beneficial for supporting activities that typically involve children being able to move around a physical space and that work better with adult support.

Our exploration, not surprisingly, revealed that high user motion related to low attention to technology (see Figure 2), with most systems featuring high attention to technology and low user motion. Likewise, high user motion corresponded with more interactions with the physical environment (see Figure 3). Figure 4 clarifies that most systems tend to require a high level of attention to technology, which is associated with few if any interactions with the physical environment. A classic example of a system with low user motion, high attention to technology, and low interactions with the physical environment is *KidPad* (Hourcade, Bederson, and Druin 2004), which involved children collaborating on a computer to design stories through the use of multiple mice. In general, all systems where children collaborate on a single screen, whether on a static display (Druin et al. 1997; Hourcade, Bederson, and Druin 2004), a mobile display (Hourcade, Bullock-Rest, and Hansen 2012), a projection (Moraveji et al. 2008), or a tabletop (Piper et al. 2006), tend to have these characteristics. Some of these systems include the use of tangible user interfaces (Scharf et al. 2012). *StoryCarnival* is among a smaller group of systems that support children moving around the physical space while interacting with it, with

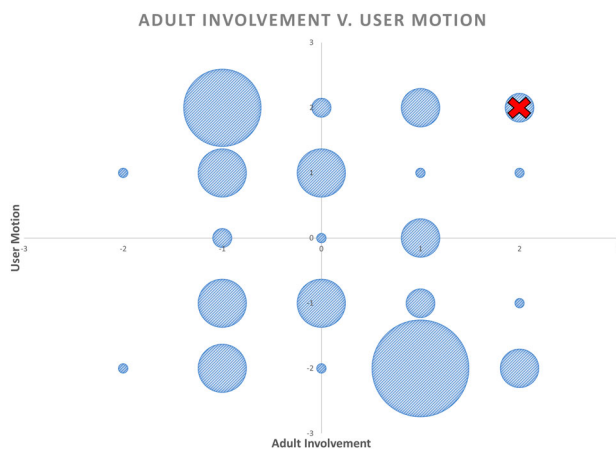


Figure 1. Distribution of papers based on adult involvement and user motion.

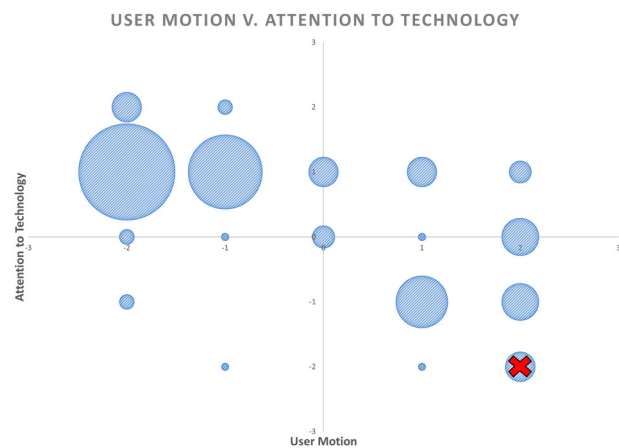


Figure 2. Distribution of papers based on user motion and attention to technology.

USER MOTION V. INTERACTIONS WITH PHYSICAL ENVIRONMENT

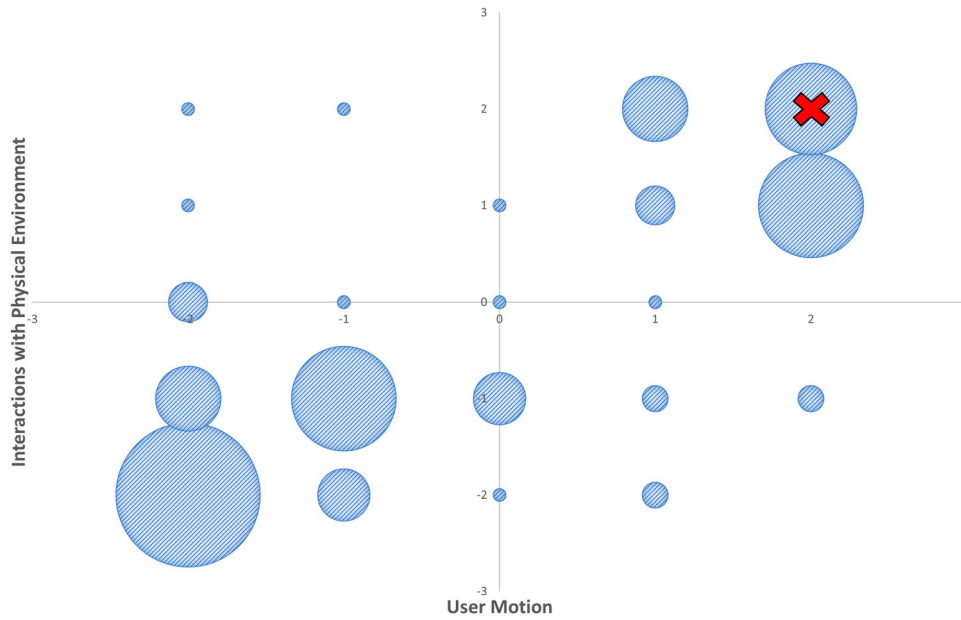


Figure 3. Distribution of papers based on user motion and interaction with the physical environment.

ATTENTION TO TECHNOLOGY V. INTERACTIONS WITH PHYSICAL ENVIRONMENT

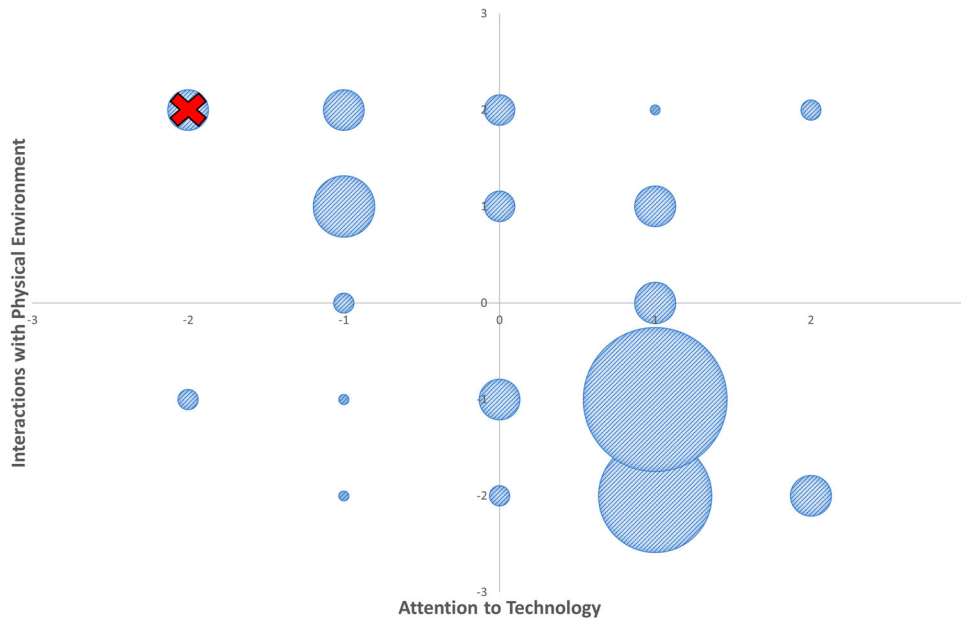


Figure 4. Distribution of papers based on attention to technology and interaction with the physical environment.

their main point of attention being other children, adults, or non-electronic physical items. In these systems, technology is in a supporting role.

A consistent theme in our investigation of the literature is that one of the areas that is understudied is that of

technologies to support face-to-face activities where children primarily pay attention to things other than technology including other children, the physical environment and adult facilitators, and where they are free to move around as they would in traditional play

settings. *StoryCarnival* fits within this understudied category of technology supporting a type of activity for which there is ample empirical evidence of benefits for preschool children: ToM-style play.

3. Characteristics and benefits of sociodramatic play for preschool children

ToM-style play is a type of sociodramatic play. The key characteristics of sociodramatic play include role-play (e.g. children pretending to be someone they are not), the symbolic use of objects (e.g. pretend a foam block is a fruit), pretend actions and situations (e.g. moving hands pretending to mix cookie dough), continuity of play (e.g. actions are within the frame of previous actions in play), interaction with one or more play partners, and communication with these play partners about play (Azmitia 1996). While sociodramatic play may involve real-life situations, a common approach is to derive play frames from media or storybooks (Azmitia 1996). The ability to participate in this type of play typically emerges around age 3 and increases through the preschool years (Short-Meyerson 2010), making preschool years a key time to support this kind of play. Typical stages on the path toward sociodramatic play start with children observing other play partners, then playing beside them, finally communicating to coordinate play (Short-Meyerson 2010). Adult facilitators (typically teachers) can play important roles in helping sociodramatic play happen including providing space, time and materials, helping children plan play, helping continue and elaborate pretend play (including helping children role-play), mediating between children and fostering communication between them, and integrating children (Azmitia 1996; Bodrova and Leong 2007; Sesame Workshop 2012; Short-Meyerson and Abbeduto 1997).

Benefits of sociodramatic play identified by researchers include children's development of communication skills, negotiation and theory of mind (Short-Meyerson 2010), more complex and emotionally invested social interactions (Currin et al. 2021), better social coordination (Currin et al. 2021; Short-Meyerson 2010), and executive function skills (e.g. working memory, inhibitory control, task switching, cognitive flexibility) (Blair and Raver 2014, 2015; Diamond et al. 2007; Diamond and Lee 2011; Mottweiler and Taylor 2014). Multiple studies involving hundreds of children associated improvements in executive function skills (Blair and Raver 2014; Diamond et al. 2007) and improvements in children's academic progress (Blair and Raver 2014) with a specific implementation of sociodramatic play: the *Tools of the Mind* (ToM) approach to early

childhood education (Bodrova and Leong 2007). Table 1's description of mature play characteristics according to ToM also presents some of the main differences between ToM and more generic approaches to sociodramatic play, including an emphasis on play planning, children setting common goals for play, playing roles with specific characteristics, interactive dialogue and negotiation to coordinate and resolve disputes, improvisation and creativity, the use of generic physical props instead of realistic-looking toys to help better facilitate their symbolic use, and active participation of teachers to support the activities (Bodrova and Leong 2007).

4. *StoryCarnival* development and description

StoryCarnival was designed to make it easier to implement ToM-style play. Pantoja et al. designed *StoryCarnival* over 39 sessions working with two groups of 3–4-year-old children at a preschool (Pantoja et al. 2019). During these sessions researchers identified areas that made ToM-style play difficult to implement and added technology supports for these (Pantoja et al. 2019). *StoryCarnival* has three components: e-book-style stories that introduce play themes and characters of equal importance on which to base play; a play-planning tool; and a Tangible, Authorable Voice Agent (TAVA) to engage the children during play (Pantoja et al. 2019).

4.1. Stories

ToM-style play requires all participating children to have a common understanding of a story on which to base play (Bodrova and Leong 2007). This common understanding helps children establish common goals and facilitates communication among children (Azmitia 1996; Short-Meyerson 2010; Short-Meyerson and Abbeduto 1997). Stories in children's media typically include one or two main protagonists, making it difficult to set up ToM-style play because most children want to play the protagonist(s). *StoryCarnival*'s solution to this barrier is to provide interactive stories with characters who all have similar importance, each with a different skill that is helpful in the context of the stories.

The stories are experienced as an e-book, showing one page at a time, with narration and character speech included as part of the story (both generated through Amazon Polly's speech synthesiser), together with speech bubbles as recommended by best practices (Sesame Workshop 2012). Every story presents each character's special skills and provides examples of how they can help each other. While the stories set up a context, some challenges and characters, they do not

provide resolutions. This approach is intended to encourage children to develop their own resolution for each story through role-play. See [Figure 5](#) for screenshots of the Space Explorers story.

4.2. Play planning

The StoryCarnival developers also noted that planning play could be difficult because children did not always remember the traits of story characters ([Pantoja et al. 2019](#)). The play planner part of the StoryCarnival app shows a story's characters from which to select, and upon selection reminds children of the selected character's skills and role in the story. The play planner also uses Amazon Polly's speech synthesiser to generate character speech. See [Figure 6](#) for screenshots.

4.3. Keeping children engaged through tangible, authoritative voice agents

Without continuous support during play, the StoryCarnival developers found that sometimes children would drift away from the story theme or stop playing collaboratively with other children ([Pantoja et al. 2019](#)). While facilitator intervention is an option in these situations, they wanted to provide support through technology in a way that would complement an adult's intervention. They explored the use of tangible voice agents, which can support play without obstructing physical or social activities. They noticed several

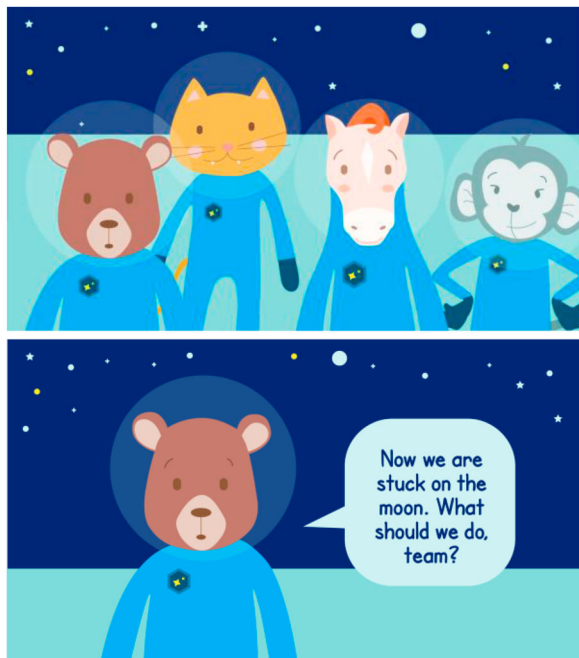


Figure 5. Screenshots from the Space Explorers story.

positive impacts on children's social play: (1) children acted as mediators of the voice agents, asking other children, for example, to help the voice agent with a request; (2) voice agents promoted social interactions with peers; and, (3) voice agents could redirect children's behaviour to re-engage with play ([Pantoja et al. 2019](#)). When children listened to a voice agent, they tended to reply to prompts by either conversing with the agent or acting on its suggestions. Making voice agents tangible enabled children to incorporate them into their play, placing them inside constructions made from props, augmenting them with other props, and expressing affection toward them through hugging or petting ([Pantoja et al. 2019](#)).

In this work, we used a voice agent called MiniBird. MiniBird is made of laser-cut layers of cardboard glued together (8.57 cm × 8.57 cm × 7.62 cm), a Bluetooth speaker, and artwork to give it its appearance (see [Figure 7](#)). The researchers controlling MiniBird could type text in an app that would produce speech through the Bluetooth speaker using the Amazon Polly speech synthesiser. MiniBird was therefore a Tangible, Authorable Voice Agent (TAVA), in that it was controlled by adult facilitators rather than being automated.

5. Comparing sociodramatic play with and without StoryCarnival

5.1. Research goal

The goal of the study presented in this section of the article was to understand how the technology supports



Figure 6. Screenshots from the play planner corresponding to the Space Explorers story showing the initial screen and the screen shown when Horse is selected.



Figure 7. The MiniBird voice agent.

provided by *StoryCarnival* change sociodramatic play when compared to ToM-style play without technology supports. A prior publication focuses on an analysis of how sociodramatic play changed for shy children (Currin et al. 2021). In the analysis presented in this article, we focus on signs of children's play maturity (Bodrova and Leong 2007), as presented in the introduction, such as children's social coordination, the role of adult facilitators including their use of the TAVA, children's interactions with the TAVA, and the influence of *StoryCarnival's* stories on play.

5.2. Methods

5.2.1. Participants

After obtaining approval from our University's Institutional Review Board, we recruited five 3-year-old children (3 girls, 2 boys, age 42–45 months at the beginning of the study) and twelve 4–5-year-old children (6 girls, 6 boys, age 50–65 months at the beginning of the study) from a preschool in a city with a population of about 100,000 in the United States by sending recruitment packages to participants' parents through their teachers. The preschool is located in a census tract identified as a low-income community. We obtained informed consent from parents, and children could interrupt their participation at any time if they wanted to stop playing. Parents indicated that four 3-year-olds and seven 4–5-year-olds used tablets 10–60 min per day, primarily to use video streaming and educational apps. Parents also indicated that one 3-year-old and two 4–5-year-olds used voice assistants for 1–15 min per day to play

music and check the weather forecast. While we did not ask parents about languages spoken at home, all participating children appeared to have native English language fluency. We also did not ask about developmental delays, but none were brought to our attention by parents, teachers, or children.

5.2.2. Design

We conducted the study over eight weeklong phases in which children engaged in ToM-style play. During half the sessions, they did so with no technology supports (A phases), while during the other half they did so supported by *StoryCarnival* (B phases). All children went through phases in the same order, which was assigned at random (order: A, B, B, A, B, A, A, B), and children participated in two sessions during each phase (see Table 2). We considered evaluating each component of *StoryCarnival* separately, but we thought it made sense to evaluate all the supports previously identified by researchers together and follow up with further studies identifying the impact of each component if necessary.

5.2.3. Materials and procedure

We conducted all sessions at the participants' school between October and December of 2019, just before parents picked up their children, at the teachers' suggestion. Children came into the room with a teacher or aide who stayed to observe the activities. All five researchers who participated in sessions had prior experience working with children. Two had experience facilitating ToM-style sociodramatic play for more than two years and another had reviewed a significant amount of video material of ToM-style sociodramatic play. Children participated in sessions only with children in their same age group (e.g. the 3-year-old group never interacted with the 4–5-year-olds). Sessions typically lasted about 25 min. We video and audio recorded every session.

All sessions began with children experiencing a story, facilitated by one researcher. During A (no-tech) phases, we used stories from the *Detective Dinosaur* series, which we identified as both appropriate for the age group and for ToM-style play with the help of three children's librarians. The specific stories we used

Table 2. Sessions for each group of children by week. A sessions did not involve technology while B sessions were supported by *StoryCarnival*. During the first four sessions (marked by *) 4–5-year-old children split into two groups, while during the remaining sessions they split into three groups.

Week	1	2	3	4	5	6	7	8
3yo	A	A	B	B	B	A	A	B
4–5yo	A*	A*	B*	B*	B	B	A	A

were: ‘The Case of the Missing Hat’ and ‘Night Patrol’ from *Detective Dinosaur* (Skofield and Alley 1996), ‘Lost’ and ‘Found’ from *Detective Dinosaur Lost and Found* (Skofield and Alley 1998), and ‘Under the Weather’ from *Detective Dinosaur Undercover* (Skofield and Alley 2010). During B (*StoryCarnival*) phases, we showed children stories through the *StoryCarnival* app using an iPad (4th generation): ‘Party’, ‘Castle in the Woods’, ‘Castaways’ (two parts) and ‘Space Explorers’ (two parts). The researcher delivering the story to the children also asked questions (e.g. ‘What do you think will happen next?’ or ‘How do you think [a character] is feeling?’) to emphasise the content of the story. Regardless of the phase, the story-experiencing portion of the activity lasted about five minutes.

After experiencing a story, the 3-year-old children stayed in their group of five with two researchers, while the 4–5-year-old group split up into smaller groups which were more appropriate for play activities. The 4–5-year-old children’s teacher or aide assigned them to groups for each session. During the first two phases (one A and one B phase) the 4–5-year-old group split into two groups of six, each supported by two researchers. During the rest of the phases, the 4–5-year-old group split into three groups of four, one supported by two researchers, and two each supported by one researcher. We made this change because we found it challenging to keep six children socially engaged in the same group and because prior work with *StoryCarnival* found that groups of four children were ideal (Pantoja et al. 2019).

The children then selected characters to play, prompted by a researcher. During A (no-tech) phases, one researcher asked children one at a time which character they wanted to be, often having to remind children of the available characters and their roles. During B (*StoryCarnival*) phases, the children selected characters using the play-planning portion of the *StoryCarnival* app. The play-planning portion of the activity typically lasted two to four minutes.

After selecting roles, children played with each other, using generic props (e.g. foam shapes, hats), pretending to be characters in the story. In A (no-tech) phases, the researchers interacted directly with children, guiding them to play together and stay within the make-believe context, and sometimes joining in play. In B (*StoryCarnival*) phases, if there were two researchers available, one played the same role researchers played in A (no-tech) phases, while the other one controlled the speech of the voice agent, MiniBird. If only one researcher was available, they played a hybrid role of interacting directly with children while also controlling MiniBird.

5.2.4. Data analysis

We conducted three types of content analysis of the video recordings: a conventional approach in which we categorised open-ended observations, a summative approach in which we quantitatively analysed transcripts, and a directed approach in which we coded for specific behaviours targeted by ToM (Kawas et al. 2020). In the following paragraphs we explain each approach in detail.

To conduct our conventional content analysis, the three most senior researchers watched the video recordings. At least two of these researchers watched each video. The researchers independently wrote open-ended observations on 894 sticky notes and organised them in an affinity diagram to extract themes using Lucidchart (Online Diagram Software and Visual Solution, Lucidchart n.d) over the course of several meetings. We note the session(s) corresponding to an observation with labels denoting age group, whether it was an A or B session, and the session number (e.g. ‘3B05’ refers to a 3-year-old B session numbered 5) in Appendix B. For the 4–5-year-old observations, we also use ‘x’, ‘y’ or ‘z’ to distinguish between the different groups of children in which the behaviour was observed during a given session (e.g. ‘4B06x, 4B06y’ would indicate that the behaviour was observed in two 4–5-year-old groups during a B session numbered 6).

For the summative approach, three other researchers transcribed the video recordings using a consistent pseudonym scheme for each participant. These researchers transcribed speech as consecutive lines by the same person if there was a clear pause waiting for a reply between lines or a clear change in subject. Another researcher wrote Python scripts to process the transcripts and calculate the number of lines and words each child, facilitator and MiniBird spoke during each session and whether lines mentioned MiniBird. The scripts also calculated the average lines and words per minute by category of speaker for each session (e.g. children, facilitators, MiniBird). To better understand children’s patterns of verbal exchanges the scripts calculated, on a per-child basis, the number of times children spoke after other children, a facilitator, or MiniBird. For each of these instances the script also tracked how many times each category of speaker (facilitators, MiniBird, or other children) spoke in a row before a specific child responded. With these calculations we sought to learn whether there were differences between conditions in who children responded to and how many times they spoke before children responded. This use of transcripts is relevant to the ToM goal of children speaking to each other as they play (Bodrova and Leong 2007, 151).

For the directed approach, two coders used BORIS (Friard and Gamba 2016) to code specific behaviours observed in the 3-year-old group's videos and 15 of the 4–5-year-old group's videos. They coded each video together, ensuring agreement on all codes. A different researcher coded the remainder of the 4–5-year-old group's videos in addition to a randomly selected video out of the 15 already coded, achieving a Cohen's Kappa value of .71. The researchers coded for the following: time off-task (as defined by Bodrova and Leong 2007), number of distinct symbolic uses of props, and for B (*StoryCarnival*) phases, the amount of time children spent physically engaged with the voice agent (e.g. holding or putting props on the agent).

We conducted the statistical analysis of the data extracted from the transcripts and the coding of specific behaviours using SPSS 25. We checked each variable for normality using the Shapiro–Wilk test and for sphericity using Mauchly's test. If the data was normal and the sphericity assumption was not violated, we used repeated measures ANOVAs (we report means, standard deviations, F and p values, as well as, η_p^2 for effect size where .0099, .0588 and .1379 are used as benchmarks for small, medium and large effects Richardson 2011) and otherwise used Friedman's test (we report medians, X^2 and p values, as well as Kendall's w for effect size Tomczak and Tomczak 2014). In addition, we graphed data and carefully analysed descriptive statistics given the relatively small number of children and sessions, which may not always yield statistically significant results for findings worth reporting.

5.3. Results

In previously published work, we reported our findings that children were more likely to be on-task (e.g. engaged in an activity related to the group's play) during *StoryCarnival* (B) sessions than no-tech (A) sessions, children were more verbally engaged overall in B (*StoryCarnival*) sessions than A (no-tech) sessions, and that these differences appeared to be mainly due to MiniBird giving shy children the motivation and confidence needed to engage their peers in play, making participation in the *StoryCarnival* sessions more equal (Currin et al. 2021). There were also no statistically significant differences in the symbolic use of props during play. In this work, we aim to describe differences in children's play at the group level with and without the *StoryCarnival* supports in more detail, elaborate on patterns we observed in children's interactions with MiniBird, and outline outstanding

implementation challenges. Open-ended qualitative observations are linked to the sessions in which they were observed in Appendix B.

In the sections below, we discuss in detail aspects of play directly related to play maturity as explained in the introduction, and the impact of *StoryCarnival* components on these. We discuss coordinated versus parallel play, facilitator interactions, voice agent interactions, the impact of different types of stories on play, and challenges we faced during the activities.

5.3.1. Coordinated vs. parallel play

As we mentioned in the introduction, coordinated play is both an important characteristic of sociodramatic play (Rubin, Bukowski, and Parker 2006) and a specific goal for *ToM*-style play (Bodrova and Leong 2007), while parallel play is a step below in terms of play quality (Bodrova and Leong 2007; Rubin, Bukowski, and Parker 2006). Through our conventional content analysis, a key finding was that children in the 3-year-old group were more likely to coordinate play during B (*StoryCarnival*) than A (no-tech) sessions, but that coordination characteristics were similar across sessions for the 4–5-year-old group.

More specifically, we found that children in the 3-year-old group were slow to engage with one another directly in the first few A (no-tech) sessions. They played in parallel during A (no-tech) sessions throughout the study but appeared to coordinate their play during one A (no-tech) session in early December, responding to one another's actions and ideas seamlessly. We observed this type of coordinated play between the 3-year-olds more often during B (*StoryCarnival*) sessions. Following is an example of this type of coordinated play from session 3B04, with support from an adult facilitator (R1):

Phyllis (walking around to pick up hats): And birthday hats.

Pam: I need one.

R1: You need one, Cat? Do you want this one?

(Pam puts on the hat.)

R1: Does everyone need one?

Jim (pretending to drive a car): Vroom vroom not me!

R1: You're going too fast, right?

Jim: Vroom vroom vroom!

(Phyllis puts on a hat and gives one to Lucas.)

R1: Do we need anything else from the store? Oh! I don't think we have balloons yet – can you get us balloons?

(Jim pretends to drive to the store and Phyllis gives R1 a hat, which R1 puts on.)

R1: Thank you! I'm all ready for the party now.

Jim: Vroom vroom! I got a lot of balloons.

The 4–5-year-olds' play was less coordinated than the 3-year-olds' play in both types of sessions. Parallel play between the 4–5-year-olds appeared variable depending on the social dynamics of specific groups, regardless of condition. Some children appeared to particularly dislike playing with certain others, and children occasionally split off to play with one or two group members independently of the other group members. In these cases, they had coordination with one or two other children, but not with the entire group. The 4–5-year-olds appeared to play most collaboratively when they were focused on building something from a story. While we observed this behaviour in both A (no-tech) and B (*StoryCarnival*) sessions, it was an especially interesting observation because multiple *StoryCarnival* stories specifically reference characters building or fixing items. In line with this, the 3-year-olds used props for building more often in B (*StoryCarnival*) sessions than in A (no-tech) sessions.

5.3.2. Facilitator interactions

Adult facilitators can play important roles in supporting sociodramatic play, with the goal of transitioning children to more independent, mature play, as recommended by researchers behind ToM (Bodrova and Leong 2007). In other words, adult facilitators should provide assistance when needed while avoiding taking 'too much of the lead in play' (Bodrova and Leong 2007).

Our conventional content analysis provides details on how facilitators participated during each type of session. The general finding was that they had to take a more central role during A (no-tech) sessions than during B (*StoryCarnival*) sessions when children played more independently. In addition, facilitators played somewhat different roles in the two types of sessions mainly due to differences in the types of stories used to motivate play and the use of MiniBird.

During A (no-tech) sessions, facilitators played specific characters from the *Detective Dinosaur* stories, often to fill a role no child picked. In the 3-year-old A (no-tech) sessions, one facilitator often focused on

encouraging a shy child to engage in play and the facilitators managed conflicts that arose when children had trouble sharing. In the 4–5-year-old A (no-tech) sessions, the facilitators prompted children to rejoin play when they were distracted and guided them when they finished replaying a story, coming up with variations for the stories to keep the children interested (Table 3).

During B (*StoryCarnival*) sessions, facilitators had similar interactions with children, although they were less likely to play specific characters in the *StoryCarnival* stories, and the 4–5-year-olds' teacher intervened occasionally to manage behaviour in the one-facilitator groups. However, facilitators did have additional MiniBird-specific interactions in B (*StoryCarnival*) sessions. For the 3-year-old group, the facilitator who was not controlling MiniBird would repeat what MiniBird said if children could not hear it and reinforced MiniBird's suggestions (22.8% of facilitator lines mentioned MiniBird). Facilitators also had to repeat MiniBird in the 4–5-year-old sessions and had to manage issues that arose when children tried to play rough with MiniBird or had trouble sharing MiniBird (19.2% of facilitator lines mentioned MiniBird). As shown in Figure 8, MiniBird spoke less often than facilitators did and in our conventional content analysis we noted that facilitators focused on controlling MiniBird spoke less often.

Here we present an example of a facilitator playing a central role and attempting to move a story along in session 4A08x:

Bruce (using a block as a phone): Hello.

R1 (picking up another block): Hello! I hear you!

Boo: Hello!

R1: Hello, Detective Dinosaur! What's going on?

Bruce: I lost my hat.

R1: You lost your hat? Oh no! Where should we go to find it?

Boo: Um, you should get a new hat at the store!

R1: At the store? Yeah! Ricky Raptor might sell hats at the store. You want to try there?

Bruce: Yeah.

Eeyore: Yeah, you should get a new hat.

Bruce: Yeah, I know.

Table 3. Comparisons between facilitators' behaviour under the two conditions.

Measure	Age	Mean/Median A (no-tech)	Mean/Median B (<i>StoryCarnival</i>)	Stat	p-value	Effect size
Words/minute	4–5	79.54	63.93	$X^2 = 6.545$	.011	Kendall's $W = .298$

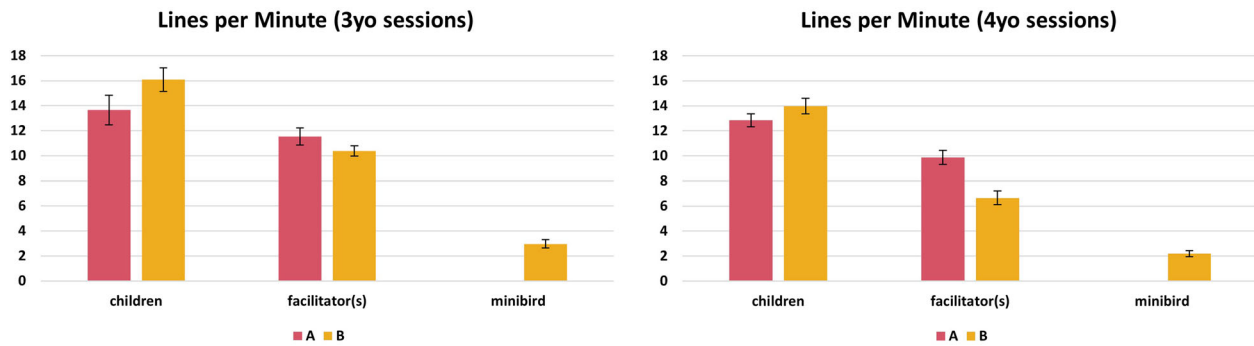


Figure 8. Lines per minute for 3-year-old sessions on the left and 4–5-year-old sessions on the right. Bars correspond to mean values and error bars are two standard errors long. To calculate children values, all lines spoken by children during A (no-tech) session were added and divided by the length of the session. Similarly, if multiple facilitators were in A (no-tech) session, all their lines were added, then divided by the length of the session.

R1: *Okay. Bye! (hangs up the phone)*

Here we present an example of the children directing play more independently in session 4B06z:

(Dora suggests throwing a ‘stinky party’ instead of a birthday party.)

Pooh: *I can dump stinky spray on you, MiniBird.*

R3: *Is MiniBird stinky now?*

Pooh & Sonic: *Yeah.*

Pooh: *This is a stinky party.*

Kanga: *Stinky spray.*

Sonic: *The bird is stinky.*

Pooh: *I’m going to stink.*

R3: *I know, I am too.*

Dora: *Not me!*

R3: *Not you? How come you’re not?*

Pooh: *Because I put water in the air.*

These differences were also reflected in session transcripts. For example, in 4–5-year-old sessions, facilitators spoke more words per minute during A (no-tech) sessions than facilitators and MiniBird spoke combined during B (StoryCarnival) sessions (see Table 1). For both age groups, facilitators spoke significantly more lines before children responded during A (no-tech) sessions than B (StoryCarnival) sessions (see Figure 9 and Table 2). These repeated lines by facilitators suggest both greater involvement by facilitators as well as some difficulties engaging children during A (no-tech) sessions. (Tables 4 and 5).

The centrality of facilitators to play during A (no-tech) sessions is also reflected in 4–5-year-old children being more likely to speak after a facilitator than another child in A (no-tech) sessions, even though children spoke more often than facilitators (this is possible through interactions where, for example, a facilitator speaks first, one child responds to the facilitator, the facilitator responds and then two children speak in a row). More specifically, 4–5-year-old children cumulatively spoke significantly more lines per minute after facilitators than after other children during A (no-

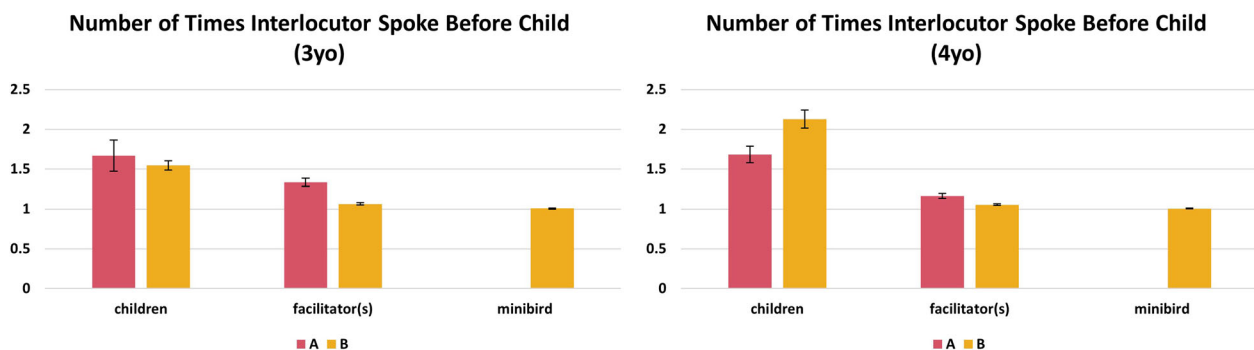


Figure 9. Number of lines a category of speaker spoke before a child spoke. Bars show mean values and error bars are two standard errors long. Data for 3-year-old sessions is on the left, for 4–5-year-old sessions on the right.

Table 4. Comparisons between children's behaviour under the two conditions.

Measure	Age	Mean/Median A	Mean/Median B	Stat	p-value	Effect size
Child speaking after another child/minute	4–5	4.432 (SD = 1.657)	6.584 (SD = 2.150)	$F(1,21) = 13.33$	.001	$\eta_p^2 = .388$
Lines by other children before child speaks	4–5	1.443	2.018	$X^2 = 8.909$	.003	Kendall's $W = .405$
Lines by facilitator before child speaks	3	1.334 (SD = .1452)	1.065 (SD = .0366)	$F(1,7) = 31.889$	.001	$\eta_p^2 = .820$
Lines by facilitator before child speaks	4–5	1.119	1.031	$X^2 = 6.545$	.011	Kendall's $W = .298$

Table 5. Comparisons between children and facilitators (and MiniBird for B (StoryCarnival) sessions) within a particular condition.

Measure	Age	Phase	Child mean	Facilitator + MiniBird mean	F	p-value	Effect size
Responses/minute	3	A	4.917 (SD = 2.316)	8.694 (SD = 1.789)	$F(1, 7) = 18.246$	.004	$\eta_p^2 = .723$
Responses/minute	3	B	6.166 (SD = 1.832)	9.922 (SD = 1.149)	$F(1, 7) = 50.124$	<.001	$\eta_p^2 = .877$
Responses/minute	4–5	A	4.432 (SD = 1.656)	8.367 (SD = 1.488)	$F(1,21) = 84.227$	<.001	$\eta_p^2 = .800$

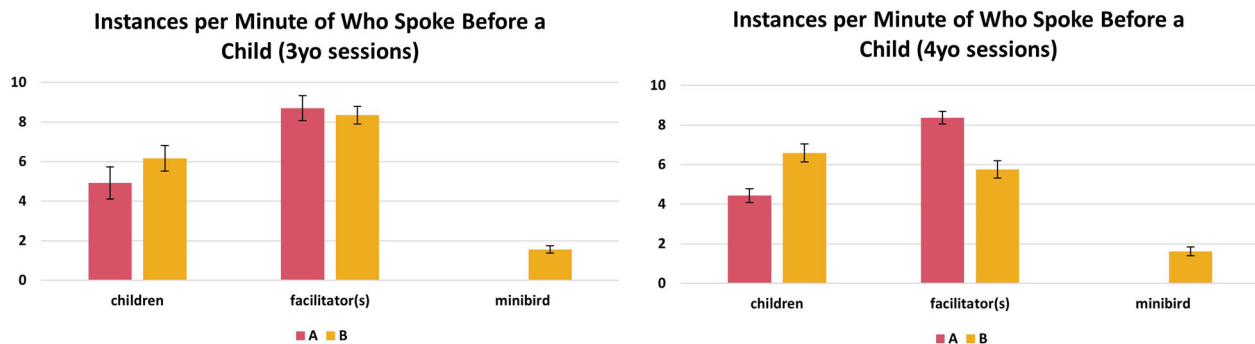
tech) sessions, but this was not the case for B (*StoryCarnival*) sessions (see Figure 10 and Table 3). These results also suggest that 4–5-year-old children engaged with their peers somewhat more independently in B (*StoryCarnival*) sessions than in A (no-tech) sessions. While 3-year-old children cumulatively spoke significantly more lines per minute after facilitators than after other children during A (no-tech) sessions, this was also true for B (*StoryCarnival*) sessions (see Table 3).

5.3.3. Voice agent interactions

The purpose of the MiniBird TAVA was to enable adult facilitators to have another line of communication and interaction with children to help support ToM-style play. In this study, during B (*StoryCarnival*) sessions, facilitators were responsible for controlling MiniBird. Control of MiniBird required use of a laptop to type what MiniBird would say. The task load involved in making MiniBird speak had an impact on how often MiniBird spoke, making its verbal interactions with children much less frequent than those children had with other children or facilitators (see Figure 10). Despite its small share of verbal exchanges, MiniBird played a role in incorporating children into play as evidenced by the correlation between mentions of MiniBird and children's lines and words spoken discussed

in previous work (Currin et al. 2021). The level of attention children paid to MiniBird is illustrated through the fact that children quickly responded when MiniBird spoke, even if they had to ask what MiniBird said (see Figure 9). Based on our directed content analysis, during B (*StoryCarnival*) sessions, 3-year-old children spent 20% and 4–5-year-old children 17% of session time physically interacting with MiniBird (e.g. holding or putting props on the agent). In the following sections, we provide details on how children interacted with MiniBird based on our conventional content analysis.

5.3.3.1. MiniBird's communication with children. In the 3-year-old sessions, adult facilitators used MiniBird to make suggestions to move the story forward and redirect children when their play drifted away from the story context. MiniBird also repeated and reinforced suggestions the children made and encouraged the children to share. In the 4–5-year-old sessions, MiniBird attempted to help children coordinate play by making suggestions to move play along, reminding children of story tasks and encouraging children to work together. The children laughed when MiniBird made jokes but could get distracted trying to convince MiniBird to say something specific. The 4–5-year-olds seemed to expect MiniBird to behave almost like a friend would

**Figure 10.** Instances per minute of what category of speaker spoke before a child. On the left, bars show mean values for 3-year-old sessions, and on the right for 4–5-year-old sessions. Error bars are two standard errors long.

and seemed disappointed when it failed to meet those expectations. Because there were two to three groups of 4–5-year-olds in one room, children had some trouble hearing MiniBird and MiniBird occasionally had to repeat itself at children's request. Some of the 4–5-year-olds tried to whisper to MiniBird and the facilitator controlling MiniBird could not hear what the children said and respond appropriately. If MiniBird did not respond to a child quickly enough, the children tended to get frustrated with MiniBird.

5.3.3.2. Wanting to interact with MiniBird. The 3-year-olds were initially shy when first interacting with MiniBird but showed interest in talking to MiniBird after some hesitation. They asked for turns holding and talking to MiniBird, quieted down when MiniBird was speaking, and sometimes insisted on hearing MiniBird repeat itself rather than having the facilitator repeat what MiniBird said if they missed it. They sometimes took on the role of repeating what MiniBird said to make sure everyone heard it. The children also responded quickly and positively to MiniBird's suggestions and often wanted to show things they built to MiniBird. In the last 3-year-old session, the children directed their attention to MiniBird even when they were not directly interacting with it.

The 4–5-year-olds were initially interested in the novelty of MiniBird, and an interest in MiniBird occasionally brought a group of children together. One group specifically made sure to bring MiniBird along when they were exploring a new area. Like the 3-year-olds, the 4–5-year-olds often wanted to show MiniBird the things they built, responded to MiniBird's suggestions, repeated what MiniBird said, asked MiniBird for opinions, and continued to direct attention to MiniBird at times the facilitator was not actively controlling MiniBird. However, the 4–5-year-olds tended to want more exclusive access to MiniBird and would take it away from the group to try to talk to it one-on-one. The 4–5-year-olds responded positively when MiniBird gave them personal attention.

5.3.3.3. Caring for MiniBird. The 3-year-old group centred their play around caring for MiniBird's needs during multiple sessions. In one session, they 'adopted' it as the other characters' 'baby' and roleplayed as parents. On other occasions they held it tightly to keep it safe during scary parts of the story, fed it, bathed it and covered it to keep it dry during a 'rainstorm'. They speculated about how MiniBird felt (e.g. 'He might be hungry'), and expressed concern about how it was doing. They built things based on MiniBird's perceived needs (e.g. they built a bed if they thought

MiniBird might be sleepy). Near the end of the study, a couple of the 3-year-old children expressed interest in how MiniBird worked, asking why it talks.

The 4–5-year-olds centred their play around MiniBird in early B (*StoryCarnival*) sessions and some in later sessions with two facilitators. They self-regulated sharing MiniBird and some children seemed to largely ignore MiniBird, especially if they were engaged in some other aspect of play. Some 4–5-year-olds expressed an interest in how MiniBird worked in the first few sessions, asking if it could do various things by itself and how it was able to speak. They asked MiniBird personal questions about its interests and allergies it might have. Rather than speculating about how MiniBird felt, the 4–5-year-olds tended to ask it directly. When MiniBird expressed a need, the children responded by gathering items to help or incorporating MiniBird into structures they had already built.

5.3.3.4. Affection for MiniBird. In addition to the active care the children showed MiniBird, they also often expressed affection for MiniBird. The 3-year-olds were initially somewhat in awe of MiniBird and giggled the first times it spoke or introduced itself (and when a facilitator made it 'dance'). One child said, 'I love you, MiniBird', directly to it during the first session. At the end of the first session, the 3-year-olds did not want to give MiniBird back to the facilitators. While this initial excitement faded over time, the children still held, hugged, kissed, smiled at and jumped with excitement at MiniBird throughout the study. The 4–5-year-olds were also excited to meet and introduce themselves to MiniBird as their characters in early sessions. They were less affectionate with MiniBird than the 3-year-olds were but still smiled and giggled when they were allowed to hold MiniBird or when MiniBird spoke directly to them. The affection and care that children demonstrated toward MiniBird showed that MiniBird influenced the children, but this influence required minimal prompting from MiniBird itself.

5.3.3.5. Aggression toward MiniBird. A few of the 4–5-year-olds showed signs of aggression toward MiniBird. They handled it roughly, especially when they had to give it up to someone else. They hit, dropped, or threw things at MiniBird and laughed if it said, 'ouch', in response. One boy suggested cutting MiniBird in half during one session. At least some of this aggressive behaviour could have stemmed from frustration when MiniBird did not respond quickly or personally enough to a specific child. We also observed children playing with other props aggressively during both types of sessions.

5.3.4. Story-related observations

There were no substantial differences in the children's initial reactions to or experiences of the stories between A (no-tech) and B (*StoryCarnival*) sessions (e.g. while listening to stories from a book or app). Below, we discuss other story-related observations based on our conventional content analysis.

5.3.4.1. Character selection observations. The 3-year-old group exhibited some trouble remembering characters from the Detective Dinosaur stories during character selection and had an easier time selecting roles with *StoryCarnival's* play planner. The 4–5-year-olds were quicker at selecting characters in both types of sessions than the 3-year-olds were. A couple of 4–5-year-old children refused to pick a character during most A (no-tech) sessions and wanted to build instead or play as characters from other media. In one A (no-tech) session, one of these children decided to play as the lid of a trash can which made a clanging sound in the story. These children would usually select a role during B (*StoryCarnival*) sessions based on the type of activity the character was primarily responsible for (e.g. if they wanted to build, they would pick the character that built a shelter in the story), even if they showed some initial resistance to picking a character. Another 4–5-year-old always wanted to play a cat, which happened to work out in B (*StoryCarnival*) sessions as there was always a cat character in *StoryCarnival* stories, but there was a cat in only one Detective Dinosaur story.

5.3.4.2. Replaying versus continuing stories. The main difference between A and B (*StoryCarnival*) sessions with respect to how play started was that during A (no-tech) sessions children would typically begin by recreating at least part of the story they listened to, while during B (*StoryCarnival*) sessions they would pick up where the story left off. In early A (no-tech) sessions, the 3-year-olds expressed excitement about replaying the *Detective Dinosaur* stories and spent the whole session replaying a story. In later A (no-tech) sessions, they largely discarded the storylines and instead wanted to skip to their favourite parts of the story or play within the general story theme or characters without following the plot of the story. In an early A (no-tech) session, the 4–5-year-olds expressed initial excitement about replaying the story as the story characters, but over the course of the study frequently requested to change roles midway through A (no-tech) session. This was most common when a child was waiting for the next time their character appeared in the story or got bored of their role. In these scenarios, children asked to play as puppies, kitties, baby dinosaurs,

superheroes, and characters from the Mario franchise. The 4–5-year-olds rushed through story replay in A (no-tech) sessions, skipping over story details and finishing replay halfway through the session time. Sometimes the 4–5-year-olds never finished replaying the story. Other times they replayed the story multiple times in A (no-tech) session or blended the story with another *Detective Dinosaur* story.

Children did not always know what to do after they finished replaying a *Detective Dinosaur* story and relied on suggestions from facilitators during these transitions. They either switched to replaying a different *Detective Dinosaur* or *StoryCarnival* story or extended the original story, keeping certain story elements (e.g. finding a cat) and taking the story in a new direction (e.g. building a house for the found cat).

In the first B (*StoryCarnival*) session, the 3-year-olds played within the setting of the story but without much relationship to the plot of the story. In subsequent B (*StoryCarnival*) sessions, the 3-year-olds tended to pick up play from the end of the story and extend the plot as their characters. The 4–5-year-olds approached the *StoryCarnival* stories similarly to the 3-year-olds: picking up from the end of the story and extending it in a creative direction. In later B (*StoryCarnival*) sessions, the 4–5-year-olds were especially quick to execute their roles and began working on story-related tasks without any prompting from facilitators. In B (*StoryCarnival*) sessions, the 3-year-olds never switched to a different story and always stayed in the general context of the original story. They had ideas for how to extend the *StoryCarnival* stories (e.g. if a character built a boat in a story, the children could extend the story by sailing in the boat). The 4–5-year-olds switched to different stories less often in B (*StoryCarnival*) sessions than A (no-tech) session and were more likely to continue extending the stories than they were in A (no-tech) sessions with less guidance from facilitators. Role switching also happened in 4–5-year-old B (*StoryCarnival*) sessions, but less frequently than during A (no-tech) sessions. Children in all groups suggested making small changes to stories' plots and incorporated concepts from other stories, class, home, and other media in both A (no-tech) and B (*StoryCarnival*) sessions.

5.3.5. Challenges

5.3.5.1. Behavioural. Children's challenging behaviour was similar across A (no-tech) and B (*StoryCarnival*) sessions. For the 3-year-old group, the most common struggle was sharing props, and in B (*StoryCarnival*) sessions the added difficulty of sharing MiniBird. There was also some destructive behaviour, mostly knocking down another child's prop-built

constructions, motivated by attention-seeking. The 4–5-year-old children displayed destructive behaviour similar to that of the 3-year-old children, but more often and with the addition of throwing props, also seeking attention. With 4–5-year-old children we observed fewer issues with sharing props than we did with 3-year-old children, as well as fewer challenges sharing MiniBird.

5.3.5.2. Noise and distractions. The 4–5-year-old children participated in sociodramatic play in two or three separate groups simultaneously in a large room as explained in Section 4.2.3. This setup, which could occur in any classroom attempting to implement ToM-style play, brought about two challenges. The first was that the noise level tended to be higher, which made it more difficult for the facilitator to understand children, and sometimes for children to hear MiniBird, as discussed in Section 4.3.3.1. Having the children’s teacher present alleviated some noise issues. A less frequent problem was children becoming interested with what was happening in another group.

5.3.5.3. MiniBird control in one-facilitator groups. When 4–5-year-old groups had one facilitator during B (*StoryCarnival*) sessions, we noticed that it was difficult for the facilitator to interact with children directly and control MiniBird at the same time. The user interface to control MiniBird was designed for a laptop computer, requiring the full attention of a facilitator. Therefore, facilitators in these groups had to decide at any given point whether to control MiniBird or engage directly with children.

5.4. Discussion

5.4.1. StoryCarnival’s impact on play maturity

The educators behind ToM-style play provided contrasts between mature and immature sociodramatic play (Bodrova and Leong 2007), which we listed in Table 1. If we consider these characteristics of mature play, the results presented above suggest that *StoryCarnival* may provide advantages with respect to characteristics (3) (play roles with specific characteristics instead of not playing within roles), (5) (coordinate play with multiple roles instead of engaging in parallel play), and (8) (can continue play from prior sessions instead of only being able to engage in play for 5–10 min), while not providing any disadvantages for any of the other characteristics.

With respect to (3), some children were more easily able to select characters from *StoryCarnival* than *Detective Dinosaur* stories and to continue play with these characters. Part of the reason may be that *StoryCarnival*

stories made an emphasis on character traits, whereas *Detective Dinosaur* stories had stronger storylines with memorable events. Another factor, at least for 3-year-old children, was the play planner, which emphasised character traits once again.

With respect to (5) the better coordination of the 3-year-old group may have been due to the centrality of MiniBird during play. In our conventional content analysis, we observed that the 3-year-old group tended to keep MiniBird in a central location with respect to the rest of children, and children holding MiniBird typically wanted other children to know what MiniBird was saying. This common point of interest and reference, MiniBird, helped children coordinate their play. On the other hand, 4–5-year-old children were more likely to take MiniBird to the side, which did not decrease coordination when compared to A (no-tech) sessions, but did not help with play coordination as compared to the 3-year-old group. In a prior publication, MiniBird was also identified as a key contributor to engaging children who were not even engaging in parallel play, but just observing (Currin et al. 2021), which is typically a precursor to parallel play (Rubin, Bukowski, and Parker 2006).

In terms of characteristic (8), we found evidence of children needing greater support for continuing play during A (no-tech) session than B (*StoryCarnival*) sessions, and to stay within the context of a single story. These differences may have to do both with the different types of stories used to motivate play and with the use of MiniBird during B (*StoryCarnival*) sessions to suggest story directions and things to do next.

5.4.2. TAVAs augmenting facilitator capabilities

The sociodramatic play literature is clear on the importance of the role of adult facilitators during sociodramatic play (Ashiabi 2007; Bodrova and Leong 2007; Gmitrova 2013; Monighan Nourot 2015). Most of the roles these facilitators are called to play involve communicating with children. The importance of communication was reflected in the summative content analysis of transcripts, which showed high levels of adult facilitator verbal engagement throughout sessions. The addition of the MiniBird TAVA during B (*StoryCarnival*) sessions enabled facilitators to have another way of communicating with children through a character with which children could relate in a very different way (e.g. holding it and taking care of it). In a previous publication we provided evidence of facilitators using MiniBird to integrate children who otherwise had difficulty joining play (Currin et al. 2021). In this paper’s results we provide evidence of MiniBird’s role in helping coordinate and extend children’s sociodramatic play.

5.4.3. Impact of stories used to motivate play

The *StoryCarnival* approach to stories, introducing a story setting, characters with clear traits, and a situation to resolve, appears to be more novel than we expected. It fits between the use of stories with an ending from books to set up play (Danielsdottir 1998) and the prompts used in improvisational theatre (Moshavi 2001). Perhaps the closest approach is the use of simple scenarios in sociodrama to get participants to solve a problem through acting (Pecaski McLennan 2012). However, in sociodrama, the actors do not play make-believe characters in make-believe scenarios, there are typically no prepared stories but topics to address, and the goals of the activity are very different from those of sociodramatic play, including ToM (Pecaski McLennan 2012).

While the approach to *StoryCarnival* stories could be achieved through non-electronic media (e.g. books), electronic versions provide the advantage of easy access to stories designed specifically to set up sociodramatic play. In addition, the latest version of *StoryCarnival* (developed after this study) includes story templates that can be used to generate a large number of distinct stories by enabling adult facilitators (with the optional input of children) to select story settings, characters, places, vehicles, food and so forth.

5.4.4. Implications for child-computer interaction

An implication of our research experience is that activities that consist mostly of interacting with other children and with non-electronic physical items can be positively influenced by technology that is not the primary focus of attention. Previous similar examples include research on supporting outdoor games (e.g. Avontuur et al. 2014) and outdoor spaces augmented with sensors and actuators (e.g. Tieben et al. 2014). There is an opportunity to rethink similar activities to explore potential roles of interactive technologies to support desirable outcomes, while keeping the focus of the activities on connections with the social and physical environment.

We also found value in designing for the entirety of the activity, rather than one piece of it. *StoryCarnival* supports children and adult facilitators through motivating, planning, and implementing the activity. It also uses different technologies for different parts of the activity. Having well-integrated experiences that include support for all phases of an activity may make it more likely to happen as intended. Such support is likely to be particularly important for activities such as those described in the previous paragraph, where social aspects require group coordination and planning, and where technology is not the primary focus during the activity itself.

The research also highlighted opportunities for the use of TAVAs. By having them be controlled by adult facilitators, in contrast to commercial voice assistants, TAVAs are similar to puppets, except they are not physically connected to an adult, making it easier to incorporate them into play. Because they are controlled by adults they can provide a level of context-aware personal interaction with children that automated voice assistants do not come close to matching. Another advantage of TAVAs over voice assistants is that they do not need to collect data, therefore preserving the privacy of children and their families.

TAVAs may provide more approachable ways for interacting with some children, providing opportunities for better inclusion in preschools, for parents who find it difficult to communicate with their children, and for therapists treating children diagnosed with communication disorders. There could also be opportunities for children to control TAVAs, for example, enabling children with speech disorders to have a TAVA speak on their behalf.

The main research challenge for TAVAs is to minimise the cognitive load needed to control them. Since conducting this research, we have developed a touch-based user interface for controlling MiniBird, which we expect would work best if it minimises any need to type. We also think it may work best if adult facilitators are able to control MiniBird from a wrist-strapped smartphone, such that both hands would remain free and there would not be a need to physically move to access the user interface. However, the best options for control may well be different for other contexts of use.

With respect to the design of our TAVA (MiniBird) it was clear that it supported greater buy-in among younger children (Pantoja et al. 2019). It is not at all surprising that different characters will appeal to children of different ages and that individual children will change in their preference. Therefore, a recommendation for TAVA design would be to enable choices of agents. This recommendation is consistent with suggestions Hubbard et al. made based on their study of children's agency in child-agent interaction, in which they asked children to choose one of their stuffed animals to embody a conversational agent (Hubbard et al. 2021). They could be designed such that visual artwork representing the character on the device could be changed, whereas it would be very easy to change the voice generated by the speech synthesiser. Such an ability to give children a choice of a TAVA that is associated with a character of interest could enhance the TAVA's effectiveness.

5.4.5. Considerations for pandemic context

Given the evidence outlined in the introduction on the negative impacts of the pandemic on children's socioemotional health, there is a need to consider extra supports for reintegrating children into social contexts and for them to feel comfortable playing, learning, and growing together with other children. There is likely a non-trivial number of children who may be joining preschools having never experienced regularly occurring interactions with other children their age. It is important that these children not feel excluded and that they feel comfortable joining social activities they can enjoy. Sociodramatic play appears ideal to re-integrate children because it builds social competencies and executive functions as outlined in the introduction. *StoryCarnival's* support for more coordinated, creative play is an added benefit. The child-computer interaction community should consider additional strategies to help re-integrate children socially and restore their socioemotional health and skills, giving parents and educators a broader toolset in a time of need.

5.4.6. Limitations

Our work is mainly limited by conducting our observations in one preschool with a small number of children (i.e. a small sample size). It is possible that results could have been different with other children in other preschools, in particular in areas socioeconomically and culturally different from the school where we conducted the research. However, our observations with respect to interactions with TAVAs are consistent with prior experiences with other preschool children (Pantoja et al. 2019, 2020). The activities were also conducted by researchers as opposed to teachers. Future research should focus on the ability of teachers to use the system.

6. Future work

We currently have three different paths in which we continue research on *StoryCarnival*. First, we are exploring the use of *StoryCarnival* with neurodiverse children, both at home and in play groups run at a therapy centre. Second, we are working on expanding support for teachers, trying to make the system as usable as possible, while supporting teachers in setting goals, planning sessions, and reflecting on outcomes. To support these two paths, we are making *StoryCarnival* publicly available at storycarnival.org. Third, we are planning to expand *StoryCarnival* to support other evidence-based practices with a focus on reducing children's social anxiety and promoting inclusive play.

Technology supports designed similarly to *StoryCarnival*, with stakeholders in a central role, have the potential to address current barriers to adoption of evidence-based practices in preschools (Foster 2022) by incorporating teachers' points of view, not requiring teachers to attend training they may not be able to afford, fitting within currently accepted practices (e.g. having technology in a supporting rather than a central role), and keeping teachers in control. Using technologies with similar characteristics could help with the adoption of other evidence-based practices with older children as well.

7. Conclusion

The COVID-19 pandemic has greatly disrupted many children's lives, affecting their socioemotional health and development. We believe that technologies can play a role in re-integrating children and enhancing their socioemotional development by supporting evidence-based, creative, face-to-face social activities. We argue in particular for supporting activities where the focus is on other children and non-electronic objects, and where technology, in a secondary role, changes the dynamics of the activities in a beneficial manner.

In this article, we presented evidence that this particular approach to supporting children's face-to-face activities has not received much attention and present a mixed-methods evaluation of *StoryCarnival*, a set of technologies designed to support sociodramatic play in the style of the *Tools of the Mind* approach to early childhood education. We provided examples of how *StoryCarnival* changed the dynamics of children's sociodramatic play during our observations, leading to more mature play, including greater coordination, ability to stay in-role, and continuing play based on a story theme when compared to our observations of similar activities without *StoryCarnival*.

We hope our work inspires other researchers and practitioners to consider strategies to use technology to enhance children's face-to-face social activities while keeping the focus of the activities on connecting directly with others and with the physical world. 8. ACKNOWLEDGMENTS We would like to thank the participants, their parents, and the teachers and staff at the preschool where we conducted the research. This material is based upon work supported by the National Science Foundation [grant number 1908476]. We would also like to acknowledge Luiza Superti Pantoja and Liam Crawford who put a significant amount of work in the design and development of *StoryCarnival*.

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Appendices

Appendix A. Survey articles

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Appendix B

Table B1. Observed behaviours coded during the conventional analysis along with session labels indicating the sessions during which each behaviour was observed.

Observation	Sessions
Disengaged children engaging in play when given a turn with MiniBird	4B04x, 4B05z, 4B06z, 3B10, 3B15, 3B16
3-year-olds slow to engage with one another directly	3A01, 3A02
Parallel play	3A02, 3A07, 3A08, 3A12, 3A14, 3B15
Coordinated play	3A12, 3B04, 3B10, 3B15, 3B16
4–5-year-olds less coordinated than 3-year-olds	4A01y, 4A01x, 4B03y, 4B04y, 4B06x
Children splitting off from the group	4B04y, 4B05z, 4B06x, 4B06y, 4A08y, 4A12z
Coordinated play focused on building	4B06y, 4B09x, 4B09z, 4A11z, 4A12x, 4A12z, 4A14y, 4A14z, 4B16z
Building with props	3B03, 3B04, 3B05, 3B06, 3B09, 3B10, 3B15
Facilitators taking role of a character	3A07, 3A08, 4A08y, 4A08z, 3A11, 4A11y, 4A11z, 4A12y, 4A13y, 3A14, 4A14y, 4A14z
Facilitators trying to engage shy child	3A01, 3A08, 3A12
Facilitators managing sharing conflicts	3A12, 3A13, 3A14
Facilitators prompting children to rejoin play	4A01x, 4A02y, 4A07y, 4A12y
Facilitators guiding children after replay	4A01y, 4A08x, 4A08y, 4A12z
Teacher intervention to manage behaviour	4B03y, 4B05y, 4B06x, 4B06y
Facilitators focused on controlling MiniBird less talkative	4B05x, 4B05y, 4B06x, 4B09y

(Continued)

Table B1. Continued.

Observation	Sessions
MiniBird redirecting children	3B06, 3B09
MiniBird reinforcing children's ideas	3B04, 3B09, 3B10
MiniBird encouraging children to share	3B10, 3B15
MiniBird encouraging coordination	4B03x, 4B05z, 4B06x, 4B06y, 4B15x
Children distracted by MiniBird	4B06z
Children expecting MiniBird to behave like a friend	4B06z, 4B10y
Trouble hearing MiniBird, asking MiniBird to repeat self	3B05, 4B05y, 4B06y, 4B09z
Children whispering to MiniBird	4B09z, 4B09y, 4B10y, 4B16y
Frustration at slow MiniBird responses	4B06z, 4B10y
Early shyness around MiniBird	3B03
Asking for a turn with MiniBird	3B09, 3B15
Quieting down to listen to MiniBird	3B09
Repeating MiniBird	3B04, 3B05, 3B09, 3B10, 3B16, 4B03y, 4B05y, 4B05x, 4B09x
Quick response to MiniBird request	3B06, 3B15, 3B16, 4B03x, 4B05y, 4B10z, 4B15x, 4B15y
Showing MiniBird construction	3B03, 3B05, 3B09, 4B04x, 4B09z, 4B10y, 4B10z, 4B15z
Directing attention at MiniBird without direct interaction	3B16, 4B09x, 4B09y
Interest in novelty of MiniBird	4B03x, 4B03y
Interest in MiniBird bringing group together	4B03x, 4B09x
Bringing MiniBird to explore new area	4B09x
Asking MiniBird about opinions, interests, or allergies	4B04x, 4B05x, 4B05y, 4B05z
Positive response to individual attention from MiniBird	4B03x, 4B04x, 4B05z, 4B06z
Centering play around MiniBird	3B03, 3B04, 3B05, 4B03y, 3B09, 3B10, 3B15, 4B04y, 4B15z
Roleplay as MiniBird's parents	3B05
Protectively holding MiniBird	3B10
Feeding MiniBird	3B04, 3B15
Bathing MiniBird	3B15
Covering MiniBird to keep it dry	3B09
Speculating about how MiniBird felt	3B05, 3B06, 3B10
Expressing concern for MiniBird's feelings	3B06
Building for MiniBird	3B03, 3B05, 3B09
Asking about how MiniBird works	3B15, 4B03y, 4B04y, 4B09y
Self-regulating sharing of MiniBird	4B03y
Ignoring MiniBird	4B10z, 4B15x, 4B16y
Asking MiniBird how it feels	4B03x, 4B05y, 4B10x
Using objects to help MiniBird	4B03x, 4B05x, 4B09x, 4B09y, 4B09z, 4B10x, 4B10y, 4B10z, 4B15x, 4B15y, 4B15z, 4B16z
Giggling at MiniBird	3B03, 3B09, 4B03x, 4B03y, 4B04y, 4B05y, 4B06x, 4B06y, 4B06z, 4B09z
Expressing love for MiniBird	3B03
Resistance to returning MiniBird	3B03
Expressing excitement for MiniBird	3B03, 3B06, 3B09, 3B15, 3B16, 4B03x, 4B04x, 4B04y, 4B06x
Rough handling of MiniBird	4B03y, 4B04y, 4B06y
Aggression toward MiniBird	4B03y, 4B04y, 4B05y, 4B06y, 4B10z, 4B15x, 4B15z, 4B16z
Suggesting cutting MiniBird in half	4B06y
Trouble remembering characters	3A01, 3A11
Easy character selection	3B15
Refusing to pick a character	4A07y, 4A07z, 4A08x, 4A11z, 4A14x
Picking inanimate object as role	4A12z
Initial resistance to picking a role	4B09y
Excitement about playing characters	3A02, 4A01x
Discarding storyline	3B03, 3A07, 3A08, 3A11, 3A12, 3A13, 3A14
Asking to change role	4A01y, 4A02y, 4A08z, 4A11z, 4A13x, 4A13y, 4A14x, 4A14z, 4B15y, 4B16y
Rushing replay	4A13x, 4A13y, 4A13z
Never finishing replay	4A01x, 4A08z, 4A11z, 4A14y, 4A14z
Multiple replays	4A01y, 4A02x, 4A08x, 4A13y, 4A13z, 4A13x, 4A14y
Needing guidance after finishing replay	4A08y, 3A11
Switching to different story	4A02y, 4A07y, 4A07z, 3A08, 4A08x, 4A08y, 4A11y, 3A12, 4A13z, 3A14, 4A14y, 4B16z, 4B16y
Extending story	3B04, 3B05, 3B06, 3A07, 3B10, 3A11, 3A13, 3B15, 3B16, 4A07x, 4B09x, 4B09y, 4B09z, 4B10x, 4B10z, 4A11z, 4A12x, 4A12z, 4A13z, 4A14x, 4B15z, 4B16y, 4B16z
Starting play without prompting	4B09x, 4B10x, 4B15x, 4B15y, 4B15z, 4B16y
Trouble sharing props	3A07, 3A08, 3A12, 3A13, 3A14, 3B06, 3B10, 3B16, 4A02y, 4A11z, 4A11y, 4A13z, 4A14y, 4B05z, 4B15z, 4B15x, 4B15y, 4B16y
Trouble sharing MiniBird	3B03, 3B09, 3B10, 3B15, 3B16, 4B03y, 4B04y, 4B09z, 4B10y, 4B15z, 4B15x
Destructive behaviour	3A02, 3A08, 3A11, 3A12, 3B03, 3B05, 3B06, 3B15, 4A01y, 4A01x, 4A02y, 4A07y, 4A08y, 4A08x, 4A11y, 4A11z, 4A12x, 4A13z, 4A14y, 4A14z, 4B05z, 4B06x, 4B06y, 4B10y, 4B10z, 4B15z, 4B15x, 4B16y
Interest in neighbouring groups	4A07y, 4A08y, 4B06z, 4B06y, 4B06x
Facilitators struggling to interact with children while controlling MiniBird	4B05x, 4B05y, 4B06x, 4B09y

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ARTICLES FOR FACULTY MEMBERS

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DRAWING ACTIVITIES ENHANCE PRESCHOOLERS SOCIO EMOTIONAL DEVELOPMENT

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ABSTRACT

Visual art activities such as the processing of output in the form of drawing encourage children to use their imagination, expression, and multiple intelligences. Through visual art activities, children can participate actively in a more enjoyable learning environment. Drawing is an essential part of children in the production of various forms that can cause excitement, enjoyment, and aesthetic pleasure, thus causing it to become an essential part of the socio emotional development component preschool curricula. The methodology used in this study was a qualitative case study method. The instrument used was a face-to-face semi-structured interview with four preschool teachers under the Ministry of Education, using a purposive sampling technique. The results explain that two themes can be drawn from the interview data, namely, (i) meaningful expression and (ii) active communication. Socio emotional development and imagination are closely related to each other and the main aspects of the development of children to self-control, empathise, and collaborate with others. Therefore, children with problems in the socio emotional development can use a drawing medium to create an imaginary context that might allow them to reassess their identity and do not make mistakes in school.

Keywords: drawing activities, nonverbal drawing technique, socio emotional development, preschoolers

INTRODUCTION

Drawing provide a window to the children's socio emotional development (Betts, 2013). In understanding the socio emotional content in children's drawing, it is essential to respect their creative work even it is difficult to comprehend because socio emotional problems are not easily understood and experienced differently by every child (Dillon & Spelke, 2017). Therefore, to identify the socio emotional development based on children's drawing is not an easy task. However, arts are one of the few modalities that can contain many emotions simultaneously (Malchiodi, 1998).

Machón (2013) stated that children's drawings are the interpretation of their happiness, restlessness, fear, or sadness in drawings. A drawing reflects the influences of sociocultural aspects from adults of various cultures towards children (Shinsky & Jachens, 2014; Winkler-Rhoades et al., 2013). However, researchers must realise that drawing is a medium and a step towards the interpretation of the meaning produced by children (Dillon & Spelke, 2017).

Similarly, Machón (2013) stated that drawing could serve to help children in their development process because children at the schema stage can describe more recognisable emotional images. For example, when children are asked to create an image of happy, angry, and sad, they will usually respond with the image of a smiley face or a face with big teeth (content), gruesome face or crooked smile (angry), sad face (sad), or other expressions that can be seen in their drawings (Malchiodi, 1998). This opinion was supported by Golomb (2004), who stated that until the age of 10, children use facial expressions to express emotions, using curved lines, eyebrow, and sometimes tears to express sadness when asked to express certain emotions. Therefore, drawing can serve as a tool to identify the children's socio emotional status (Badillo et al., 2014).

Problem Statement

The use of teaching method based on drawing activity has a profound impact on children's socio emotional development. This is because the implementation of drawing activities enables children to manage and express their emotions in the right way (Dillon & Spelke, 2017). However, drawing activities are not emphasized in terms of the development of children's socio emotional especially in the meaningful context they wish to convey to others. This is proven by the study of Osher and Chasin (2016) who found that although 80% of parents consider child socio emotional development is important, they want to place a strong emphasis on basic reading, writing and counting skills (3M). So drawing is just an activity in the classroom. Children cannot express their feelings to interact with others (Danby & Farrell, 2005).

Cox (2005) stated that children's drawings are interpreted from adult's perspective who focus more on what they observe and want to express the result of the painting through communication process. This is supported by Anning and Ring (2004) who claimed that in such developmental theories, there is more focus on the technical and cognitive aspects of painting than enhancing children's communication processes. This clearly isolates and ignores children's communication skills and their thinking processes and the context of their lives as well as the meaning they wish to convey in a painting (Thompson & Tawell, 2017).

Children's Drawings

Based on the standard level of artistic development, preschoolers are in the early pre-schematic stage, the first representation to emerge and be recognised. At this stage, children can produce drawings to express meaning.

By the end of age five, various forms will appear, such as the sun or a circle analogous to a pie chart that is called a mandala. These symbols will be associated with real things that are natural to them. For example, children can use the mandala at the window of their house (Wright, 2003).

At the age of six, preschoolers can draw a happy face and use colour as an additional resource to express emotion (Cox, 2005). Excellent fine motor skills enable them to hold pencils firmly. However, as in a child's development, artistic development is different for each child. Also, Cox (1992) stated that children's drawings tend to look tiny, representing only some specific features to symbolise objects.

Although children use various visual methods and other means of communication in the growing digital and multimodal culture, studies show that preschoolers are still using the traditional tools of drawings and involved in drawing activities at least once a week (Anning & Ring, 2004).

National Preschool Standard Curriculum (KSPK) in Malaysia

Curriculum Conceptual Model in the National Preschool Standard Curriculum (KSPK) introduced in 2017 manifests the aim of preschool education of emphasising the children development in seven domains, namely cognitive, spiritual, moral, physical, social, emotional, and creative (Kementerian Pendidikan Malaysia, 2017) as the preparation for formal education in year one. The development of socio emotional development in the preschool curriculum in Malaysia focuses on the mastery of emotional maturity and social skills. Mastering these skills enable children to learn to control emotions, thoughts, and self-actions to achieve positive emotions so that they can understand the needs, emotions, and opinions of others to adapt to society and build social skills (Kementerian Pendidikan Malaysia, 2017). The importance of socio emotional development are also emphasised in each document of early childhood education in England, Scotland, Northern Ireland, and Wales (Lindon, 2005) as well as in Malaysia.

Socio emotional development is an important aspect that should be given attention in early childhood development. The existence of positive socio emotional development in early childhood equips children to grow up with a strong identity. Many studies had been conducted to prove the existence of a positive relationship between children's socio emotional development at an early age with the establishment of their personality and personal character in the future.

Socio Emotional Development and Its Relation to Drawing

Drawing can highlight the point of view or expression of a child more than speaking or writing that may generate a more detailed or more general definition about an object or a situation (Anning & Ring, 2004). For example, preschoolers may have limited resources to express ideas or objects through a written language because they have not learned to form all letters or produce a complete sentence (Christensen, 2004). Instead, they use the resources available to them, such as observation and environmental influences, to say something to others through drawing (Clark, 2011).

Drawing a beneficial tool for identifying children's socio emotional development (Driessnack, 2005; Hill, 1997; Thomson, 2008). Children's drawings are unique and different from each other because they have socio emotional interpretations according to their specific environment, situation, or context (Majita Ahmad Sultan et al., 2016). For example, Cox (1993) stated that drawings produced by children are not just the action of a natural maturation process but also involves their socio emotional development. However, this process is influenced by their cultural environment (Cox, 2005).

The continued development in the social and cultural perceptions during childhood and their selection as participants showed that children could be involved in the research process (Christensen, 2004; Clark, 2011; James & Prout, 1997). Many researchers see

drawings as child-friendly (Coates & Coates, 2011). Therefore, the use of drawings guarantees children-centred research (Muhamad Firdaus Ramli & Rofidah Musa, 2020). Previous studies show that children's drawings are used as a tool that allows the child to react and engage openly (Einarsdottir et al., 2009).

Children's drawings are unique as the environment influences each child's interpretations, situation, or context they are in (Mohd Kamal Mohd Ali et al., 2013). Children draw for several reasons, among which is facilitating socio emotional development and expression, translating feelings and emotions, conveying information, as centre aesthetic objects, or only as a pastime (Matthews, 1997; 2003). Children's drawings are a means of communication to express their emotions (Einarsdottir et al., 2009).

Application of Drawing in Integrating Children Socio Emotional Development

To encourage the involvement of children wholly, Hill et al. (2004) demands States Parties to respect children's rights, including their right to express their opinions and make decisions in matters affecting them. Children have the right as social actors and have the knowledge to act and interpret their world (Bitou & Waller, 2011; Farrell, 2005; James & James, 2004; James et al., 1998; Mayall, 2002; 2000; Moss & Petrie, 2002). Therefore, children can be trusted as active participants (Alderson, 2005) and the provider of credible information (Morrow, 2005). Children can comprehend, investigate, and contribute to the research process, including drawings and emotional expressions that deserve the necessary attention (Christensen & James 2000; Greig et al., 2007; Uprichard, 2010). As suggested by Fraser et al. (2014), in the framework of this study, children are the focus of research, knowledge, and data involving them in the data collection process.

Research Objective

This study aims to explore socio emotional development of preschoolers through drawing activities. Some specific objectives have been developed as follows:

1. To explore children's meaning expression based on the drawings they produce during drawing activities.
2. To explore the communication processes existed in children's drawings.

METHODOLOGY

Research Design

This study selected case study as the research strategy. Case studies are aligned with qualitative research design (Yin, 2014). Case study strategies are consistent with the nature of the study and the types of data collected and analysed in this study. This strategy is ideal for single case analysis as it produces detailed and complete results (Creswell & Poth, 2018). The advantages of semi-structured interview and document analysis are transparent research methods because the coding scheme and sampling procedure can be clearly defined (Creswell & Poth, 2018). Therefore, further review and further study should be carried out in the future.

Research Sampling

Participants in this study were four preschool teachers with experience of preschool teaching between 10 and 18 years old. All selected preschool teachers have a bachelor degree in early childhood education and have a master's degree in preschool education. All participants were female, aged 35 to 48 years. In addition, the preschool teachers teach six-years-old in preschool under the Ministry of Education Malaysia (MOE).

Data Collection Method

As this is a qualitative study, data collection was carried out using triangulation method which is interview and document analysis. The purpose of this triangulation is to complement, enhance and strengthen data collection because in qualitative studies, data are collected from interviews as premier data while document analysis as secondary data. This is consistent with Bryman's (2012) opinion that the analysis of document content against secondary data is useful when studying a sensitive issue because it is written without realizing that document content analysis is likely to be done in the future. Thus, interviews were conducted in a semi-structured way to enable information gathered from the participants of the study while the document analysis using children's drawings during drawing activities was conducted in the classroom to support the interview data.

Data Analysis Technique

Upon completion of the data collection, audio interviews were transcribed and subsequently coded, while drawings were used as a medium to highlight meaningful expression and communication processes between teachers and children involved in the study. Typically, data analysis in case studies is thematic, which is a technique for identifying and analysing forms (themes) in data (Bryman, 2012). Therefore, in this study a thematic analysis was conducted to explore children's socio emotional development according to the themes formed based on coded data. This analysis was performed using NVivo12 software.

RESULTS

This section discusses the findings of the interviews. Data were obtained from the interviews with the four preschool teachers. Two themes can be drawn from the interview, namely, (i) meaningful expression and (ii) active communication.

Meaningful Expression

Children's expression highlights a more profound meaning and individual perspective as well as reflects their reality. Any emotional expression is not only about a phrase but more to the process of hearing and be heard that should be taken seriously. This perspective is seen as an opportunity for children to express their emotions.

Whatever they drew really has its own meaning... We must ask the children what are their true intentions ... (T1)

True...sometimes through drawings, the children want adults to know of what they want to tell us...so, we must concern of what they want to tell us... (T3)

Children's emotional expression would allow adults to adapt to their needs and understand their socio emotional. Children express their emotions through active interaction with various people and situations.

Okay, after I asked what they meant, they explained to me and it made it easy for me to help them... (T2)

Sometimes, it is hard for children to tell us verbally...there must be things like drawings...when we ask then they talk to us...easy for me to prepare anything they need... (T4)

Children's expression is a diverse and multidimensional social construction that changes the dynamic interaction process. This perspective is consistent with the sociocultural theory where children's socio emotional are affected and explained by daily context, experience, and human relations.

Whatever they say are considered as a communication process with other people...they will talk when there is a thing like this drawing...they will talk when we ask... (T1)

Sometimes, I found that they talked to their friends after they drew...they talked about the drawings...I saw there was a good interaction process... (T3)

I witnessed a fun process because they wanted to tell about their drawings...they will answer when their friends asked...it is good to have such an interaction process going on... (T4)

In this study, socio emotional is seen as a means for children to say whatever they do and convey whatever they think. Children's socio emotional can be heard by creating space to convey an understanding in the mode and medium suitable for their development, which is drawing.

With this drawing activity, I could hear the children's expression through drawings...there are happiness, sadness and some are angry... (T2)

They express so many things through drawings...all sorts of feelings...happy, sad, excited, furious, angry...all that can be identified through drawings... (T1)

This study encouraged children to use drawing as a language to express their emotions about things that become the main subject of the drawings that are often misunderstood, ignored, or deemed irrelevant by adults. This allows researchers to see children's drawings and interpret their views on socio emotional in daily experience from the children's point of view. This study also provided information about the influences of other people and the environment on the children's thoughts, feelings, and expression.

Communication Process

Listening is an active, interactive, and reflective communication process involving hearing, interpreting, constructing, and expressing meaning. It is a dynamic and ethical process that is open to different communication modes in a focused environment.

I just listened to them which sometimes makes sense...but I listened to them carefully, so they will not feel disheartened... (T3)

I listened to them until the end...I enjoyed all sorts of stories but I shared the moral lesson of the stories and shared my opinions as well... (T1)

Listening is an active verb that involves interpretation and giving meaning to the message and value to those who are being given attention. Children use various symbols and codes to express their socio emotional.

Through the objects they drew, I asked what is this? What is that? Later they explained to me...I listened and I cared... (T2)

As a teacher, I must give attention to what the children talked about even though I did not understand the symbols and objects they drew...that is why I listened carefully and tried to understand... (T4)

From this perspective, drawings can be defined as a verbal and nonverbal interactive process or, in other words, through different sentence production modes, constructing meaning, and theory. Listening assists researchers in understanding how children express their socio emotional and how children respond to interpreting their emotions.

DISCUSSION AND IMPLICATIONS

Based on the results of this analysis, this study suggests that any emotion expression is not just about an expression but may be more of a listening process that needs to be taken seriously. This is because, children draw to tell their experiences to others. Thus, nonverbal drawing techniques for exploring the social status of children's internal emotions can be heard and given attention by parents and teachers in understanding their socio emotional (Skybo et al., 2007; Hamama & Ronen, 2009). In addition, these findings are also in line with the study conducted by Daglioglu et al. (2010) stated that drawing gives children the opportunity to explore an experience and to express it through their own interpretations. Any emotional expressions shared by children enable adults to adapt to their emotional needs and social understandings.

In addition, drawing activities are not just a description or expression of children in relation to their social environment, but also a dialogue between the children and the reality they know. This is because, the active communication process creates space for different modes of communication in a focused environment. Children use a variety of symbols and codes to express their utterances. Therefore, the process of listening in children's communication involves interpreting, giving meaning to their messages and values to parents and teachers. Drawing help parents and teachers understand how children express socio emotional and how children respond to interpret emotions in reality. This method is the basis

of learning for children and enables them to develop their social skills in preschool (Durlak et al., 2015). This view is supported by (Ionescu, 2015) who stated that socioemotional development of each child influences their success in a preschool.

Based on this finding, it is clear that the use of drawing is very appropriate to attract children to participate in the study. This is because the use of drawing has the advantage of certain features for preschoolers to use such as expressing meaningful emotions and enhancing their communication process with others. This finding is also supported by Dewaraja et al. (2006) who stated that drawing is used as a medium to identify children's anxiety levels by expressing their feelings effectively. Besides, drawing is an effective way to collect data directly from preschoolers regarding their socio emotional development (Oster & Crone, 2004; Tanaka & Sakuma, 2004). Therefore, drawing activities can give children the opportunity to express themselves in meaningful ways, thus improving the communication process more effectively in their daily activities.

Therefore, the present study could be continued by other researchers in the future by engaging more experienced teachers in preschool to gain different perceptions and opinions on the benefits of drawing activities to children. Other studies can also be done by focusing on other aspects such as the cognitive, physical, creativity and perceptions of children through drawing activities. With further research as suggested, research on early childhood development is expected to highlight the ability to interact, speak, express feelings, respect and so forth through drawing activities.

CONCLUSION

Drawing activities give children an opportunity to interact and improve their social skills and thus enhance their socio emotional development. For example, they interact with each other during drawing activities. This gives children an opportunity to express their feelings, to be respectful of each other, which is also the basis for instilling a sense of tolerance with everyone. Thus, drawing activities can enhance children's socio emotional development while also helping to balance their imaginative power.

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ARTICLES FOR FACULTY MEMBERS

CHILDREN'S SOCIOEMOTIONAL SKILLS

Effectiveness of Mandala Coloring Intervention on Children's Preoperative Anxiety: A Randomized Clinical Trial Study in Iran / Shahrabaki, R. M., Omidi, A., Shaterian, N., & Makarem, Z.

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Effectiveness of Mandala Coloring Intervention on Children's Preoperative Anxiety: A Randomized Clinical Trial Study in Iran

Abstract

Background: Mandala coloring is a distraction strategy to reduce the anxiety in children. However, it has received little attention for the management of anxiety in hospitalized children. This study aimed to examine the effectiveness of mandala coloring on preoperative anxiety in children. **Materials and Methods:** This randomized controlled trial study was conducted using a pre-test-post-test design in two intervention and control groups. The 64 school-age children, who were admitted to the pediatric surgery ward in Mofid Hospital in Tehran, were allocated to the test and control groups, using a single-blind block randomized design. Children in the control group underwent routine preoperative visits. Meanwhile, the children in the intervention group, mandala coloring intervention was done at least one hour before entering the operating room for 15–20 minutes. The level of anxiety was measured through the Spielberger State-Trait Anxiety Inventory, before and after the intervention of both groups. Results were analyzed using *t*-test and Pearson correlation. **Results:** In the intervention group, there was a statistically significant in post-intervention than the pre-intervention and the children reported a lower level of anxiety ($t = 4.51$, $df = 31$, $P = 0.01$). But, after the intervention, there was not a statistically significant between the intervention and control groups in terms of average trait ($t = 1.31$, $df = 61.86$, $P = 0.194$) and state anxiety levels ($t = -0.152$, $df = 58.94$, $P = 0.879$). **Conclusions:** The results indicated that likely, mandala coloring intervention was not effective in reducing preoperative anxiety in children. Further studies are needed to more assess the effects of mandala coloring on anxiety of children undergoing surgery.

Keywords: Anxiety, art therapy, child, management, mandala coloring, preoperative

Introduction

Surgery, as a stressful experience, often leads to psychological reactions in children before surgery. The most obvious preoperative reaction is anxiety manifested in the form of nervousness, worry, or even fear.^[1,2] According to previous studies, 50 to 80% of children experience severe anxiety before the induction of anesthesia.^[3-5] During the preoperative period, several factors including wearing unfamiliar clothes, waiting to be transferred to the operating room, fear of surgery and anesthesia, separation from family members, and encountering the unfamiliar environment of the operating room and surgical staff can induce or intensify fear and anxiety in children undergoing surgery.^[2,6,7] Anxiety is described as an unpleasant feeling of unexplained worry or discomfort associated with psychological and behavioral symptoms.^[8,9] Anxiety is an emotional state of transition or organic condition of the individual. Trait anxiety is

defined as the tendency or genetic, latent, and stable predisposition with behavioral and neural responses to negative emotional situations as a danger. The state anxiety is defined as the anxious reaction of the autonomic nervous system when faced with a stressful stimulus, generating apprehension, fear, and agitation.^[10-12] Preoperative anxiety can lead to increased heart rate, decreased pain threshold and greater demand for painkillers after surgery, increased restlessness during recovery, sleep disorders, night crying, bedwetting, mood swings, increased postoperative infections, and delay in wound healing, all adversely affecting postoperative recovery in children.^[4,13,14] There are various pharmacological and non-pharmacological methods for managing anxiety, among which pharmacological factors such as the use of benzodiazepines for the treatment of anxiety can increase the risk of respiratory suppression, side effects, and worsening of clinical symptoms. For this reason, non-pharmacological interventions,

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such as art therapy, may be safer alternatives.^[14,15] Art therapy is a subset of anthropomorphic medicine. According to the American Art Therapy Association (AATA), art therapy is a creative process to improve the physical and mental state and is a useful tool for coping with stress and anxiety.^[16] Mandala coloring is one of the branches of art therapy that can be effective in controlling anxiety.^[15] Mandala designs start from a central point and expand towards infinity with nested circles.^[17,18] Coloring mandala patterns diverts the child's attention from the disease and the surrounding environment and increases the child's focus on coloring the circles and has positive effects on improving hope, flexibility, and adaptation to the disease as well as the feeling of well-being and peace in hospitalized patients.^[19]

Khademi et al.^[15] (2021) showed that mandala coloring improved anxiety symptoms caused by COVID-19 and hospitalization in adult patients. Moharamkhani et al.^[19] (2023) also found that mandala painting can reduce anxiety in 9–14-year-old children with cancer. It seems that most of the studies in the literature have highlighted the need to investigate the effectiveness of mandala coloring in reducing anxiety in different samples. However, given that different diseases tend to cause varying degrees of anxiety in affected patients, it is necessary to examine different diseases and their impacts on different populations, especially children undergoing surgery. Given the importance and necessity of reducing preoperative anxiety in children and the need to conduct more studies to find the most effective non-pharmacological methods for reducing anxiety in children, aimed to examine the effectiveness of mandala coloring on preoperative anxiety in children.

Materials and Methods

The 64 children candidates for surgery admitted to the pediatric surgical wards of Mofid Hospital, affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran, who met the criteria for entering the study, were selected and randomly assigned to two groups including the mandala coloring group (32 people) and the control group (32 people). The children were allocated to the control and intervention groups using a simple lottery. The children in the mandala coloring (intervention) groups were selected in the first three days of the week (Saturday, Sunday, and Monday) and the children in the control group were in the second three days of the week (Tuesday, Wednesday, and Thursday). The sampling process continued until all children were assigned to the two groups. The current study was an interventional Randomized clinical trial with IRCT code IRCT20220203053920N1. The inclusion criteria for children were 6 to 18 years of age, full awareness of place, time, and persons, moderate to severe anxiety level based on Spielberger State-Trait Anxiety Inventory (STAI) before participation, the ability to communicate verbally, and having the physical strength to color Mandala designs. The exclusion criteria were moderate to severe pain during

the intervention (measured with a visual numerical scale), the need for emergency surgery, child's restlessness, and unwillingness to continue the study. The sample size was estimated using the following equation^[20,21]:

Where the probability of the first type error was $Z_{\alpha/2} = 1.96$ for $\alpha = 0.05$, the probability of the second type error was $Z_{\beta/2} = 1.96$ for $\beta = 0.05$, the test power was equal to $1 - \beta = 0.95$, and the effect size was $\frac{(\mu_1 - \mu_2)}{\sigma} = 0.70$.

Accordingly, taking the first and second type errors as 0.05 and 0.05 at the confidence level of 0.95, the sample size was estimated equal to 32 persons per group.

Since the children in the two groups were selected on different days of the week, the children in each group did not have any contact with those in the other group. The researcher attended the pediatric ward and provided some instructions to the parents and their children about the intervention procedure and obtained informed consent from the parents. To homogenize the two groups before measuring preoperative anxiety, a brief explanation about surgery was given to children. Thus, all children had some basic information about their surgery according to their age. All children and their mothers routinely attended a room located within the operating room for 15-20 minutes, and then the children were transferred to the operating room by a nurse. During this period, the children in both groups did not receive any medical intervention. In addition to the presence of the child with his mother and receiving routine care in the preoperative phase, mandala coloring facilities were provided for the children in the intervention group. The children colored the mandala patterns before entering the operating room for 15-20 minutes. The children's anxiety was measured using a checklist on two occasions before and after the mandala coloring intervention. No intervention was performed on the days when the children in the control group were examined, and only children's anxiety was measured when the children stayed in the waiting room for 15–20 minutes before induction of anesthesia. Five different mandala designs were printed separately on A4 (0.21 × 7.29 cm) paper for the children in the mandala group. The child's anxiety was measured before the intervention and then a pack of 12 colored pencils was provided to the child and he/she was asked to choose one of the mandala coloring designs as he/she wished and paint it for 15–20 minutes.

The demographic and clinical information questionnaire included five items which are: the children's age and sex, history of surgery, type of surgery, and a history of hospitalization. The children's anxiety was measured using the Spielberger State-Trait Anxiety Inventory (STAI). This tool was developed by Spielberger in 1983 and measures patients' state and trait anxiety as a self-report scale.^[22] It consists of 20 items that measure the quality of stress, worry, anxiety, and anger based on a four-point Likert scale from 1 (very little) to 4 (very much). The total STAI score

varies from 20 to 80. The scores on the state anxiety scale are organized as 20–31 (mild), 32–42 (mild/moderate), 43–53 (moderate/severe), 54–64 (relatively severe), 65–75 (severe), and ≥ 76 (very severe).^[20] This instrument was validated in 1994 for Iranian society with the internal consistency of $\alpha = 0.91$ for the whole instrument, $\alpha = 0.91$ for state anxiety, and $\alpha = 0.90$ for trait anxiety.^[23] In the present study, Cronbach's alpha coefficient was obtained as $\alpha = 0.87$.

The collected data were analyzed with IBM SPSS Statistics v25.0 software using descriptive and inferential statistics. Frequency, percentage, mean, and standard deviation were used to describe the data. Given the number of research variables, the analysis of variance (ANOVA) was run to test the research hypothesis. Moreover, to determine the effect of the independent variable on the dependent variables, independent samples *t*-test, and Pearson correlation were used. The level of significance in data analysis was considered to be less than 0.05 ($P < 0.05$).

Ethical considerations

The protocol for this study was approved with the code of ethics IR.SBMU.RETECH.REC.1400.975 by the Vice-Chancellor for Research and Technology of Shahid Beheshti University of Medical Sciences. Verbal and written informed consent was also obtained from all participants and their parents.

Results

Table 1 shows the demographic and clinical characteristics of the participants in the intervention and control groups. As can be seen, the average age of the children in the intervention and control groups was 9.46 (1.45) and 9.21 (1.89), respectively, and out of 64 children in this study, 37 (57.81%) were boys. The results of the independent *t*-test and Chi-square test showed no statistically significant difference between the two groups in terms of age, gender, type of surgery, history of hospitalization, history of surgery and the two groups were identical in terms of demographic and clinical characteristics ($P > 0.05$) Figure 1).

The results from the *t*-test showed no statistically significant difference between the two groups in preoperative anxiety before the intervention ($P = 0.145$). But, in the mandala coloring group there was a statistically significant in post-intervention than the pre-intervention and the children reported a lower level of anxiety ($P = 0.01$). However, after the end of the mandala coloring in the intervention group and routine care in the control group, there was not a statistically significant difference in preoperative anxiety between intervention and control groups ($P > 0.05$) [Table 2].

Discussion

The present study examined the effect of mandala coloring intervention on children's preoperative anxiety. The results indicated that the anxiety reported by the children in the intervention group decreased significantly after mandala

coloring. Mandala coloring as a branch of art therapy creates a positive mental state and helps children focus their attention and devote themselves to the present moment.^[24] However, there was not a statistically significant difference in the level of anxiety in the mandala coloring and control groups before and after the intervention, indicating that mandala coloring did not have a significant effect on reducing preoperative anxiety in children. Similarly, Babaei (2021) and Al-Yateem (2016) did not find a significant association between preoperative anxiety levels in children in the painting therapy group.^[25,26] This similar finding can be attributed to the similarities in the research samples and the temporary nature of preoperative anxiety. On the contrary, Khademi (2021) who examined the effect of 30 min/day for six consecutive days performing mandala painting on the anxiety of hospitalized COVID-19 patients,^[15] and Moharamkhani (2023) who examined the effect of 45 minutes of mandala coloring on reducing the anxiety of 9–14-year-old children with cancer,^[19] reported contradictory findings. This inconsistency may be due to the differences in the sample size, the duration of the intervention and the number of intervention sessions, the average length of stay, and the acute and chronic nature of anxiety. It is still not clear how much time is needed for mandala coloring to be effective and more studies are needed to determine the minimum time required to achieve the maximum effect of mandala coloring on anxiety.^[27] It is also possible that the permanence of the stress caused by the disease in the mentioned studies has caused anxiety to become permanent and chronic, while preoperative anxiety in the present study was acute and periodic,^[28] leading to the ineffectiveness of mandalas on anxiety control. In addition, several factors such as fear of death, isolation, distance from parents and family members, dietary changes, sleep disorders, and physical symptoms affect the development and persistence of anxiety.^[15] Since the prohibition of taking food by mouth and fasting before surgery, the absence of the family members with the child in the operating room, the fear of death due to surgery, and the possibility of sleep disturbance following hospitalization are among the common preoperative conditions that can impact the effectiveness of mandala painting. Other reasons for such inconsistent findings could be attributed to the difference in the participants' age group, cultural norms, and mandala geometric designs. Thus, future studies need to investigate the presence of specific elements or their combinations, such as the spatial arrangement of circles, squares, semicircles, and triangles, which may improve the effect of mandala coloring on anxiety.^[27] The data in the present study showed no significant association between the patients' demographic characteristics and anxiety. Likewise, Kim (2023) examined the effect of art therapy on anxiety, and no significant relationship between gender and age with the level of anxiety.^[29] Finally, it can be argued that there is still no strong evidence that art therapy is effective in reducing the severity of anxiety symptoms.^[30] Thus, there is a need for further research in this field to obtain more reliable findings. As one of the limitations of the present study, the sampling was done only in one educational hospital. Thus, the findings have

Table 1: The participant's demographic and clinical characteristics

Variables		Groups		p
		Mandala n (%)	Control n (%)	
Gender	Female	14 (43.75)	13 (40.62)	Chi=0.064, df=1, p=0.80
	Male	18 (56.25)	19 (59.38)	
Age		9.46±1.45	9.21±1.89	p=0.557
Type of surgery	Appendectomy	1 (3.12)	0 (0)	df=6, p=0.676
	Umbilical hernia	1 (3.12)	2 (6.25)	
	Tonsillectomy	0 (0)	1 (3.12)	
	Gastrointestinal surgery	13 (40.63)	10 (31.25)	
	Adenoidectomy	0 (0)	1 (3.13)	
	orthopedics	8 (25)	10 (31.25)	
	Genitourinary urination	9 (28.13)	8 (25)	
History of previous hospitalization	Yes	20 (62.5)	23 (71.88)	Chi=0.638, df=1, p=0.424
	No	12 (37.5)	9 (28.12)	
History of surgery	Yes	13 (40.63)	17 (53.12)	Chi=1.004, df=1, p=0.316
	No	19 (59.37)	15 (46.88)	

**Figure 1: Shows the chart for the sampling procedure**

limited generalizability to the whole community due to the difference in the treatment and care routines of each hospital. Another limitation of this study was the use of self-report tools, which could affect the measured level of anxiety in children because the level of anxiety reported by professionals may be higher, or the anxiety reported by parents may be lower than the level reported by the child.^[31] Thus, future studies need to use other tools to measure anxiety levels in children.

Conclusion

The results of the present study showed that mandala coloring intervention reduced preoperative anxiety in post-intervention than the pre-intervention in mandala group and the children reported a lower level of anxiety. However, after intervention there was no significant

difference in preoperative anxiety between the two groups of mandala and control. Therefore, in the future, more studies are needed to assess the effect of mandala coloring intervention on the anxiety of children undergoing surgery and also on the anxiety of their parents.

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Conflicts of interest

Nothing to declare.

Table 2: Comparing the anxiety levels between the two groups

Anxiety	Groups				p value
	Intervention		Control		
	Mean	SD	Mean	SD	
Pre-intervention	89.34	17.99	82.75	17.76	0.145
Post-intervention	84.43	16.58	81.34	17.40	0.469
p value	0.01		0.134		
State anxiety	44.34	9.36	44.75	11.80	0.879
Trait anxiety	40.09	10.90	36.59	10.41	0.194

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Effects of digitalization in preschool education on the creative and cognitive development of children

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Abstract

Digitalization can potentially benefit the creative and cognitive development of children. This study aims to analyze this impact on a sample of preschool children. A total of 80 preschoolers were divided into four groups based on their age and program variables: there were two groups (control and training) of children aged 3 to 4 years and two groups (control and training) of children aged 5 to 6 years. The study uses the following data collection tools: the Torrance Test of Creative Thinking (TTCT) Figural Form A and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV). The digital intervention involved participating in a specially designed digitally-enhanced learning course entitled “Preschoolers: Digital Adventures”. Both training groups exhibited a statistically higher level of creative thinking compared to baseline, as evidenced by TTCT-A scores. The younger training group also had significantly higher scores on all WPPSI-IV subscales, while their peers in the control group failed to show such a result. Older controls significantly improved on all except one WPPSI-IV subscale, i.e., Fluid Reasoning Index subscale, while their peers in the training group scored higher on all WPPSI-IV subscales without exception. The present findings suggest that digital enhancement of the learning process in preschool education can help improve certain aspects of creative and cognitive development. The results can be used by educators and parents to integrate digital tools, applications and activities into preschool curricula.

Keywords Cognitive abilities · Cognitive development · Creative thinking · Digitalization · Education · Preschool education

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1 Introduction

In today's rapidly evolving tech-driven era, technologies penetrated various aspects of life, changing the lifestyle that existed a few decades ago (Rakhimova, 2022). Children are now introduced to digital devices from an early age and this "early contact" is almost inevitable. In the field of education there has been a paradigm shift towards the integration of digital tools in preschool institutions (Yafie et al., 2020). As a result, this has aroused the interest of scientists in understanding the influence of digitalization on the creative and cognitive development of preschoolers (Yafie et al., 2020). Preschool education plays a crucial role in the holistic development of children, as it lays the foundation for their future learning and growth. Generally, preschool classes focus on experience-based practical activities that emphasize social interaction, exploration, and creativity (Mirzajonova & Parpiyeva, 2022). In addition, when digital technologies came into existence, it has led to the emergence of many interactive educational resources, including tablets, computers, educational software, and applications (Behnamnia et al., 2023). These resources offer new opportunities for children's involvement, but also raise questions about their potential influence on children's creative and cognitive development (Behnamnia et al., 2023).

Understanding the complex relationship between digital tools and children's education is crucial. It allows teachers to harness the potential of technology and provide a balanced and developmentally appropriate educational environment (Erstad et al., 2021). Children's creative development includes a number of skills that are necessary in the modern world; therefore, its value cannot be overestimated (Suvanova, 2023). Scientists express different opinions about whether digitalization in preschool education can hinder or enhance children's creative abilities (Otajonov & Khakimova, 2022). Some argue that excessive screen time and passive consumption of digital content can limit children's creativity and reduce the time they spend exploring the real world (Ljubomirović & Grujičić, 2019). Others, on the contrary, claim that carefully designed applications and programs can promote creative thinking by providing an immersive experience (Behnamnia et al., 2020).

The key advantage of digitalization in education is to increase the quality of learning. Digital tools, such as interactive applications and educational games, make learning more dynamic and exciting (Morris & Rohs, 2023). As a result, learning stimulates the interest of young children, which can lead to improved outcomes (Kilag et al., 2023; Morris & Rohs, 2023). Digital platforms offer an individual approach to learning. Educational software is possible to adapt to the individual pace and style of learning of each child, thereby providing individual tasks and support (González-González et al., 2023). Digitalization also opens up access to a variety of educational resources, such as e-books, online lessons, and applications. These resources enrich the learning environment and take it beyond traditional methods (Harini et al., 2023). In addition, digital activities can improve cognitive skills, including memory, attention, and thinking. Thus, educational games and applications often focus on the specific cognitive areas of

young children. Digital platforms promote collaborative learning, allowing children to participate in joint projects and problem-solving, which are also very relevant for children with special needs (Anguera et al., 2023; Rezayi et al., 2023). Finally, the readiness of children for the digital future is an unavoidable necessity. Early familiarity with technology helps them adapt to technological changes and gives them the skills needed in a technological world (Livingstone & Blum-Ross, 2020).

Cognitive development includes the acquisition of knowledge, memory, attention, and logical thinking skills (MacGowan & Schmidt, 2021). Digital tools can facilitate personalized learning, create adaptive learning environments, and generate feedback, thus adapting the educational experience to the individual needs of each student. Likewise, educational applications can present complex concepts in a gamified manner, promoting active participation and knowledge retention (Bower et al., 2022; Hoareau et al., 2021). However, there are still some concerns regarding the potential adverse impact of such technologies on concentration, memory, and critical thinking skills, when children rely heavily on digital devices rather than on themselves (Stamatios, 2024). When studying the influence of digitalization in preschool education, it is important to take into account a number of various factors. These factors can be, for instance, the quality of digital content and its relevance to educational goals, the frequency and duration of using digital devices, the role of teachers and parents, as well as potential individual differences in children's reaction to digital tools (Bhavani et al., 2021; Demidov et al., 2020).

Digitalization of preschool education presents both hypothetical opportunities and hypothetical problems for the creative and cognitive development of children. For that reason, the exploration of this topic is of particular importance. Modern educational institutions should make careful and reasonable decisions when developing and implementing digital tools. This will ultimately contribute to the improvement of children's learning outcomes. The current publication seeks to contribute to the existing research on this topic and expand the understanding of digitalization by studying literary data, theoretical foundations, and conducting an empirical study. The scientific value of the publication lies in the determination of potential advantages and problems associated with the use of digital tools in early childhood. In addition, the article aims to inform teachers, politicians, and parents about the consequences of incorporating digital technologies into preschool education.

1.1 Literature review

In preschool education, the term “creative development” refers to the development and strengthening of a child's ability to think figuratively, investigate, solve problems, and express themselves in unique ways. It is also interconnected with aspects of creative thinking, artistic self-expression, divergent thinking, and the ability to generate ideas (Raxmatova & Orlova, 2023). Supporting creative development in preschool education is vitally important since the cultivation of creative abilities in early childhood lays the foundation for future success in school, career, and life in general (Djalolova & Omonov, 2019). Besides, creative development contributes

to comprehensive development, improving cognitive skills such as critical thinking, problem-solving, and decision-making (Kadirova, 2021). It also promotes the development of emotional intelligence, self-confidence and self-expression, allowing children to effectively express their thoughts, feelings, and experiences (Çetin & Erdem Çevikbaş, 2020). Likewise, creative activity in preschool institutions promotes social interaction, cooperation, empathy, the formation of relationships, and the improvement of communication skills (Khamraevna, 2022). There are many ways to support the creative development of children. Most of these ways involve activities in the form of games (Urinova & Shokirova, 2022). For example, drawing, painting, sculpting, inventing stories, doing problem-solving exercises, dancing, exploring new places, and working in a group. It is also worth noting that the role of the teacher is crucial in supporting creative development. Teachers can give recommendations, ask open-ended questions, offer resources and materials, and contribute to meaningful discussions that encourage creative thinking and self-expression of children (Jumayev, 2021).

Digitization can stimulate creative development by offering unique opportunities for interactive activities that can increase children's creative potential in various ways (Xiong et al., 2022). Despite this, digital tools should be considered as a supplement and not a replacement for the traditional teaching approaches (Haleem et al., 2022). Digital devices, such as tablets or computers, can provide access to various software and creative applications, where children can create digital images, compose music, program interactive stories etc. (Laranjeiro, 2021). Also, digital platforms offer a wide range of multimedia content, including ready-made interactive stories, animated videos, and educational games (Dasundari & Rathnayaka, 2022). Although digitalization has many advantages, it also has certain limitations when it comes to its effective implementation in preschool education (Kewalramani et al., 2020). Digital content for youngsters needs to be age-appropriate, culturally diverse, and, most importantly, educational (Xiong et al., 2022). It is also important to balance digital and non-digital activities since excessive screen time is known to hinder creative development. Replacing practical, sensory experiences and real-life interactions with their digital equivalents may cause children to become addicted to digital devices (Şenol et al., 2024). Therefore, setting appropriate safety measures and parental control over the use of gadgets is crucial for the protection of children's well-being (Lee et al., 2020; Rahmawati & Latifah, 2019). Teachers also require professional development and training to effectively integrate digital tools into their pedagogical practice (Anisimova, 2020; Su & Yang, 2024).

Children's cognitive development refers to the growth and progression of a child's thinking, their ability to solve problems, use their memory, pay attention, speak, and process information (Anmarkrud et al., 2019). Cognitive development plays a decisive role in the formation of the intellectual abilities, learning potential, and overall academic performance among children and adolescents (Benvenuti et al., 2023; Rao et al., 2014). This is why promoting cognitive development in preschool education is of utmost importance. Early childhood is a critical period for brain development, and the experience gained during this period significantly affects the child's cognitive abilities. Moreover, it lays the foundation for acquiring academic skills, helps develop concentration, critical thinking, logic, and problem-solving abilities (Miguel

et al., 2019). Much like in the case of creative development, methods of cognitive development can include game-based learning (Mushtariy, 2023). Digitization can offer children a number of tools and resources that can improve their cognitive skills (Vedechkina & Borgonovi, 2021). Educational applications, software, and online platforms offer interactive exercises, quizzes, and simulations that contribute to the development of children's cognitive skills. Examples are educational applications for learning languages (Miaomiao for learning Chinese), for drawing and reading books (Gua Gua Long), for reading stories (Kada Gushi), for learning mathematics (Todo Math), for practicing music (Baby Mozart), and for general development (IQsha). They also provide personalized learning using adaptive learning algorithms (Baltzaki & Chlapana, 2023). More importantly, digital resources present information in visual and audio formats. This improves children's understanding and memorization of various complex concepts (Vanbecelaere et al., 2020). That said, digitalization also requires thoughtful integration, the right choice of content, balanced use, and continuous monitoring (Benavides-Varela et al., 2020; Healey et al., 2019).

1.2 Problem statement

Digitalization in preschool education significantly impacts the creative and cognitive development of children. Digital technologies allow children to access a wider range of educational materials and interactive teaching methods. As a result, the learners develop their critical thinking, creative skills, and problem-solving skills. In addition, digital tools can provide a personalized learning approach tailored to the individual characteristics and learning rate of each child. This approach contributes to more effective learning and skill development. This study addresses a major gap in current education research: the impact of digitalization on the creative and cognitive development of preschool children. Although digital technologies rapidly permeate the educational environment, empirical evidence confirming their effectiveness is insufficient, especially in preschool education. This study is based on theories of education and development that suggest that early exposure to technology can significantly affect learning processes and outcomes. This empirical study aims to analyze the impact of digitalization on the creative and cognitive development of preschool-age children. The goal is to identify the potential benefits of digital technology and shed light on how to best integrate it into the preschool setting in order to effectively improve creative and cognitive development. The research questions concern important issues.

1. How does learning based on digital technologies affect the creative development of children in primary and senior preschool environments, compared with traditional ways of learning?
2. Are there significant age differences in cognitive development between preschoolers who use digital technologies and those who do not?
3. What is the reliability of the differences in creative and cognitive development between the control (traditional learning) and the training (digital learning) groups?

The rationale for the study is extremely important. Among the reasons to conduct it, there is a growing need to understand the impact of rapidly developing digital technologies on preschool education. Therefore, the article seeks to fill this knowledge gap. It aims to systematically study the impact of digitalization on the creative and cognitive development of young children. The results of this study can provide educators and policymakers with valuable information on how to effectively integrate digital tools into preschools to improve learning outcomes. In addition, in the era of digital technologies, the assessment of their impact on the youngest students is socially significant and necessary for the formation of responsible and effective educational practices. By focusing on current research issues, the study not only contributes to academic discourse but also provides practical ideas for improving preschool education. The objectives of the study are: (1) to determine whether digitally-enhanced and conventional modes of learning have different effects on the creative development of children in primary and senior preschool contexts, and if so, how strong are intragroup differences; (2) to establish the age-based differences (if any) in cognitive development among digitally-enhanced preschoolers and their strength; and (3) to estimate the reliability of differences between the control and training groups.

2 Study design

2.1 Material and methods

Here, creative thinking was evaluated using the Chinese version of the Torrance Test of Creative Thinking (TTCT-A) Figural Form A (Ye et al., 1988) previously employed by (Zhang et al., 2020). The TTCT-A covers five cognitive dimensions of creativity: fluency, originality, elaboration, resistance to premature closure, and abstractedness of titles (Torrance, 1998). The study also used the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV) (Wechsler, 1989). This measure provides scores for the Full-Scale IQ (FSIQ), the Verbal Comprehension Index (VCI), the Visual Spatial Index (VSI), the Fluid Reasoning Index (FRI), the Working Memory Index (WMI), and the Processing Speed Index (PSI) (Bai et al., 2021). The study used the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-IV) since it comprehensively assesses cognitive areas important to preschool children, providing a detailed view of their cognitive abilities. The Scale's form is suitable for preschoolers and elementary grades. Therefore, it was an appropriate tool for the target demographic of the current study. This test is closely related to cognitive development, offering important data for analyzing the impact of digitalization on various cognitive skills. In addition, WPPSI-IV helps to evaluate the effectiveness of digital educational interventions, providing additional insights into their impact on various cognitive areas in preschool children.

This study used a method that involved a quasi-experimental design, namely, a non-randomized design of groups before and after testing. The participating preschoolers were subjected to digitally-enhanced instructions specially-designed for implementation in a specific kindergarten in China and combined into a single

course shell entitled “Preschoolers: Digital Adventures”. The said course was designed to engage and support preschoolers (ages 3 to 6) in developing their cognitive and creative skills using a diverse range of digital resources, such as interactive apps, video tutorials, music, games, puzzles, and more; the components that make up the digitally-enhanced course are depicted in Fig. 1. The goal

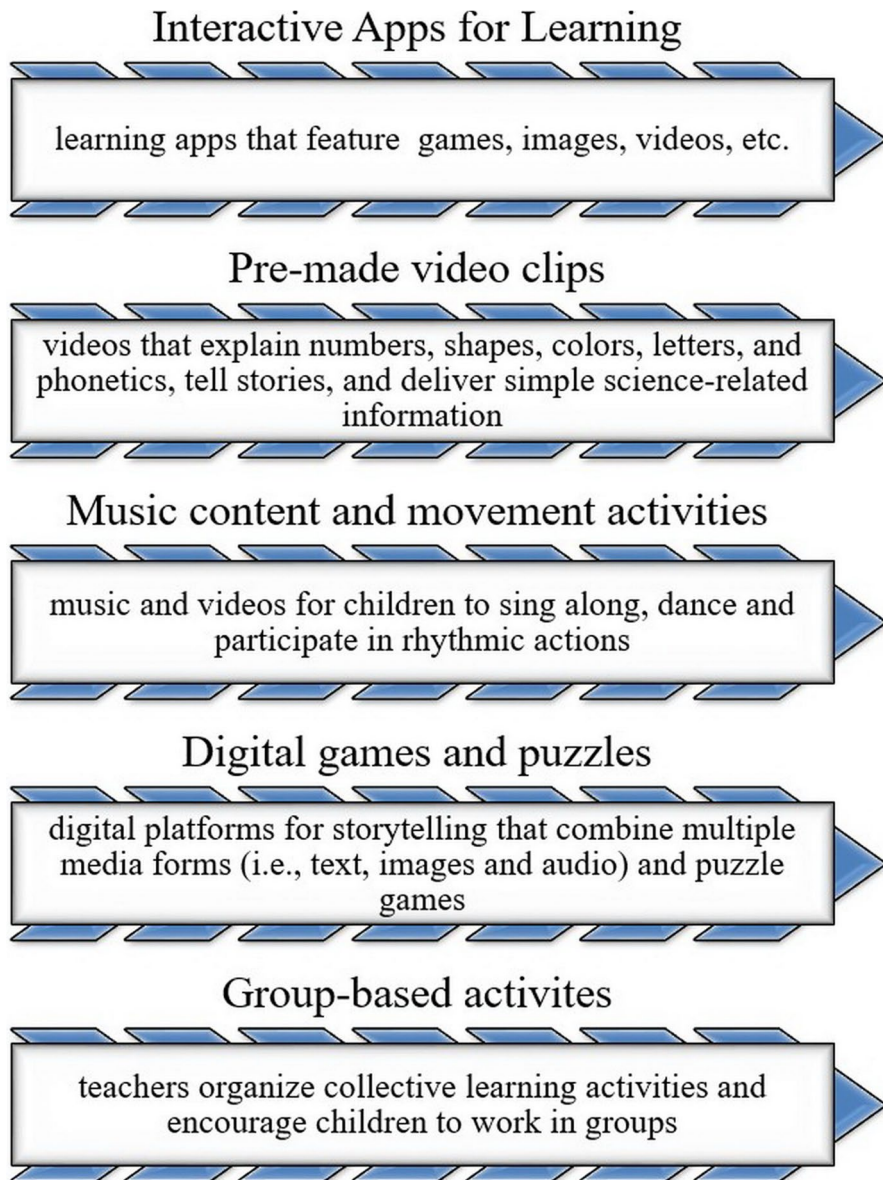


Fig. 1 A diagram that shows the core components integrated into the “Preschoolers: Digital Adventures” course for the enhancement purposes

of the digitally-enhanced course was to instill and reinforce basic skills such as: recognizing letters, numbers, colors, and shapes; drawing (Gua Gua Long), listening to music (Baby Mozart); language skills and literacy (Miaomiao and Kada Gushi); solving problems and thinking critically (Todo Math and IQsha).

The learning apps integrated into the learning process were Miaomiao (teaches the Chinese language), Gua Gua Long (provides pre-made videos, from art classes to book reading), Kada Gushi (features children's stories), Todo Math (teaches math), Baby Mozart (enables music listening) and IQsha (promotes general development). These apps were intended for use by children ages 3 years and older. Additional equipment used throughout the course includes, but is not limited to, tablets, a computer, a video projector, and music speakers.

The preschool teachers were given the task of assessing children's progress and focusing on what interests and difficulties they have. The teachers had to provide children with support in the form of timely feedback. The teachers were previously prepared for the application of the program, their experience was at least 5 years of practice in children's educational institutions. The control group of children received traditional teaching methods, which included standard preschool classes, such as writing and drawing exercises on paper, physical games, stories with books, and basic arithmetic problems. Unlike the intervention group, the control group did not use digital devices or applications as part of their training. This group listened to music through speakers, watched cartoons, and so forth only for entertainment purposes, not educational. Their learning process did not involve digital programs. The training in this group was under the guidance of teachers using traditional teaching methods, including direct instruction, practical classes, and group discussions. The influence (training) group worked with a training program, which integrated various digital tools and applications. Figure 2 shows the interfaces of the used tools.

- (1) Miaomiao: This application improved Chinese language skills and included interactive language exercises. It contained cartoons in which Miaomiao and friends have fun introducing viewers to new Chinese words.
- (2) Gua Gua Long: This tool provided a tool for lessons on drawing, poetry, and reading books. Children can receive a comprehensive education by having fun with the orange cartoon dragon Rex and his friends who interact with children and guide them in learning.
- (3) Kada Gushi: This application offers books, such as fairy tales and books for different ages. The content integrates elements of interactive activities to involve children in understanding the narrative.
- (4) Todo Math: This application implements mathematical problems as games. It teaches basic mathematical concepts, such as counting, forms, and simple arithmetic in a fun way.
- (5) Baby Mozart: The application focuses on listening to music. Children can interact with music through lessons with musical accompaniment or simple lessons on rhythm and melody.
- (6) IQsha: The application aims to develop logical, mathematical, and language skills. It expands the understanding of the world around children. As an applica-



Fig. 2 Interfaces of the applications used

tion for general development, IQsha facilitated classes aimed at cognitive skills, problem-solving, and critical thinking.

Miaomiao helped children learn Chinese through interactive language exercises and cartoons, which contributed to the development of language skills and literacy. Children learned new words and phrases by delving into fascinating stories. Gua Gua Long was used for drawing classes, reading books, and studying poetry. Children drew various thematic drawings (for example, nature, objects, animals, and so forth) together with a cartoon dragon. The dragon explained the process of creating images step by step, developing their creative thinking and imagination. In addition, this application allowed teachers to conduct poetry lessons where children listened to poetry, then tried to create their own poems under the guidance of the dragon. Kada Gushi offered a collection of books and fairy tales for children of all ages. Interactive elements in the application drew the children's attention to the plot and encouraged their active participation in the reading process. Todo Math applied mathematics education through games, offering tasks on counting, forms and simple arithmetic problems. The gamified format helped children easily learn mathematical concepts, while developing logical thinking and problem-solving skills. Baby Mozart focused on musical education, offering lessons with musical accompaniment, as well as simple lessons on rhythm and melody. Through these lessons, children developed musical hearing, a sense of rhythm, and creative expression. IQsha was aimed at developing logical, mathematical, and language skills, as well as expanding children's understanding of the world around them. Using a variety of tasks and games, this application stimulated cognitive development, problem-solving, and critical thinking.

Thus, the control group adhered to traditional, non-digital methods of preschool education. It paid special attention to teacher-led instructions and materials on physical education. In contrast, the influence group had a digital learning experience, using a range of applications and digital tools. These tools were used to improve cognitive, language, creative, and problem-solving skills in a more interactive and technologically integrated environment. The classes of the control and influence groups followed the scheduled curriculum. The difference was that the control groups did not use digitalization tools, but the influence group did. Thus, the learning objectives, as well as the amount of time allocated for learning activities, were the same. The pre-tests aimed at assessing the children's prior knowledge and skills determined the homogeneity of the groups. The Wilcoxon test established a basic equivalence, which was crucial for the reliability of the study: the p-values exceeded the level of 0.005, confirming the absence of significant differences. The study took place in mid-January through the end of June 2023. The participants completed the TTCT-A and WPPSI-IV assessments twice, before and after the course. Children attended classes every other day excluding weekends, holidays, sick leaves, and days when they did not attend the kindergarten for any other reason. The number of lessons, assignments and the app usage intensity were regulated by the teachers.

2.2 Participants

A total of 80 children were enrolled and divided into four groups: two groups were aged 3 to 4 years, and the other two groups were aged 5 to 6 years. All participants were ethnic Chinese. More details about the participants are given in Table 1 below.

The participating groups were not divided as children were accustomed to learning within these standardized groups. Moreover, it was risky to mix children, given the stress they would experience if moved to an unfamiliar environment. Therefore, the age groups were assigned the control and training statuses randomly. The control groups (A and C) received conventional learning, and the training groups (B and D) were subjected to digitally-enhanced learning (Preschoolers: Digital Adventures course). The groups were placed in different rooms and did not interact with each other during the sessions, yet, they had an opportunity to do so outside the classroom during walks. Preschool teachers in charge of the four groups have completed a training course to learn how to work with the given program and received the corresponding certificates.

Table 1 Information about participants

Groups	Total	Male	Female	Mean age	SD
A (control), 3–4 years	20	12	8	3.21	0.14
B (training), 3–4 years	20	9	11	3.18	0.39
C (control), 5–6 years	20	10	10	5.15	0.57
D (training), 5–6 years	20	13	7	5.23	0.34

2.3 Data analysis

The pre-test and post-test results were analyzed in SPSS with the help of statistical methods. The comparison was done by Wilcoxon and Mann–Whitney tests. In the context of this research, it was important to explain reliability and validity for the accuracy of the conclusions. Cronbach's alpha determined the internal reliability of the used tools. It showed whether the various test components gave consistent results. The indicators ranged from 0.86 to 0.91, which was a high level of consistency. The tests properly covered all aspects of cognitive and creative skills evaluated in this study. The validity test showed that tests and measurements accurately reflected the measured constructs (cognitive development and creative skills). In addition, the measured constructs correlated with the relevant theoretical concepts and constructions. The validity of statistical conclusions refers to the use of statistical methods. It indicates whether conclusions drawn about relationships or differences are statistically valid.

2.4 Ethical issues and considerations

The study protocol was approved by the Head of the kindergarten and the Supervisory Board. The children were informed about the digitally-enhanced learning course and asked if they would like to participate. Their parents received a detailed lecture about the intervention so that they could decide whether their child should be part of the training group. All parents provided written informed consent to participate in January 2023. The parents gave written consent for their children to participate in the experimental training and could terminate the child's participation in the study at any time. Any child could exercise the same right. Confidentiality and anonymity were guaranteed.

3 Results

The first research objective was to establish how digitalized learning affects the creative development of children in primary and senior preschool environments compared to traditional learning. To establish the impact of digitally-enhance learning on creative development, the pre-test and post-test results of the control and training groups were compared. Table 2 presents the TTCT-A findings.

As can be seen, children in training group B (ages 3 to 4) demonstrated higher performance on all post-test TTCT-A subscales compared to baseline, while the control group exhibited a slight increase in some scores and a slight decrease in other scores. In the influence group, the changes were significant: Fluency increased by 1.50, Originality increased by 1.65, Elaboration increased by 2.25, Resistance to Premature Closure increased by 2.90, and Abstractness of Titles increased by 0.95. A similar pattern was observed with older preschoolers: TTCT-A scores in the control group C (ages 5 to 6) remained static or decreased, while

Table 2 Age-based descriptive statistics for training and control groups' scores on the TTCT-A

	Fluency (pre-test)	Fluency (post-test)	Originality (pre-test)	Originality (post-test)	Elaboration (pre-test)	Elaboration (post-test)	Resistance to premature closure (pre-test)	Resistance to premature closure (post-test)	Abstractness of titles (pre-test)	Abstractness of titles (post-test)
Group A (control), 3–4 years	Mean	13.55	13.40	5.80	6.00	2.60	2.50	4.15	2.55	2.65
	Standard error of the mean	.235	.245	.138	.205	.112	.115	.198	.114	.109
	Standard deviation	1.050	1.095	.616	.918	.503	.513	.887	.510	.489
	Variance	1.103	1.200	.379	.842	.253	.263	.766	.261	.239
	Skewness	.157	.149	.120	.000	-.442	.000	-.315	-.218	-.681
Group B (training), 3–4 years	Median	13.00	13.00	6.00	6.00	3.00	2.50	4.00	3.00	3.00
	Mean	13.80	15.30	5.85	7.50	2.25	4.50	3.70	2.55	3.50
	Standard error of the mean	.247	.164	.167	.115	.099	.115	.193	.112	.114
	Standard deviation	1.105	.733	.745	.513	.444	.513	.865	.503	.513
	Variance	1.221	.537	.555	.263	.197	.263	.747	.253	.263
Skewness	-.603	-.553	.257	.000	1.251	.000	.663	-.442	-.218	.000
Median	14.00	15.00	6.00	7.50	2.00	4.50	3.00	7.00	3.00	3.50

Table 2 (continued)

	Fluency (pre-test)	Fluency (post-test)	Originality (pre-test)	Elaboration (pre-test)	Elaboration (post-test)	Resistance to premature closure (pre-test)	Resistance to premature closure (post-test)	Abstractness of titles (pre-test)	Abstractness of titles (post-test)
Group C (control), 5–6 years	Mean	15.00	14.90	7.00	6.90	3.50	3.55	4.50	4.60
	Standard error of the mean	.178	.176	.126	.176	.115	.114	.115	.112
	Standard deviation	.795	.788	.562	.788	.513	.510	.513	.503
	Variance	.632	.621	.316	.621	.263	.261	.263	.253
	Skewness	.000	.186	.000	.186	.000	-.218	.000	-.442
Group D (training), 5–6 years	Mean	15.00	15.00	7.00	7.00	3.50	4.00	4.50	5.00
	Standard error of the mean	.198	.209	.191	.196	.112	.192	.114	.176
	Standard deviation	.887	.933	.852	.875	.503	.858	.510	.788
	Variance	.787	.871	.726	.766	.253	.737	.261	.621
	Skewness	-.104	-.325	.204	-.274	-.442	.000	-.218	-.186
Median	15.00	17.50	7.00	8.50	4.00	5.00	8.00	4.50	6.00

those in the training group became higher, by comparison. In influence group D, Fluency increased by 2.10, Originality increased by 1.45, Elaboration improved by 1.40, Resistance to Premature Closure significantly increased by 3.00, and Abstractness of Titles increased by 1.60.

There were no statistically significant differences between pre-test and post-test TTCT-A scores in either of the control groups (Table 3). This finding suggests that conventional preschool learning does not enhance creativity and requires additional interventions. As for the training groups, all differences were statistically significant; this finding implies that the integration of a digitally-enhanced course can help boost the creative abilities of younger and older preschoolers.

The second research objective was to determine whether there were significant age differences in cognitive development between preschool children using digital technologies and those who do not use them. To establish the impact of digitally-enhanced learning on cognitive development, the pre-test and post-test results of the control and training groups were compared. The WPPSI-IV findings are as follows (Table 4).

In control group A, there was a slight decrease of 1.00 in the Full-Scale IQ among younger preschoolers. Other indicators, such as the Verbal Comprehension Index, the Visual-Spatial Index, the Fluid Reasoning Index, the Working Memory Index, and the Processing Speed Index, increased by 2.40, 0.70, 1.70, 2.30, and 1.70, respectively. Influence group B showed improvement in all indicators, with the largest increase in the Verbal Comprehension Index by 4.35. As for older preschoolers in control group C, they improved all indicators but the largest increase was in the Visual-Spatial Index by 2.05. Influence group D also showed an overall improvement, especially in the Processing Speed Index (which increased by 4.65) and the Full-Scale IQ (which increased by 3.50). To estimate the significance of intragroup differences in WPPSI-IV scores, the Wilcoxon test was performed. The results are depicted in Table 5.

Group A exhibited statistically significant differences in scores for the VCI, FRI, WMI and PSI subscales, which suggests that conventional learning facilitates those aspects of cognitive development that the said subscales represent. In the training group, the differences were significant for all subscales, indicating a stronger boosting effect of digital immersion and gaming on cognitive development compared to conventional learning. Older controls exhibited differences for all subscales, except for the FRI scale, which measured conceptual thinking, reasoning skills, and classification ability. The older training group showed significant differences in all subscales with no exception. Hence, digitally-enhanced learning seems to be more effective in developing cognitive abilities in younger and older preschoolers.

The third research objective was to determine the reliability of differences in creative and cognitive development between traditional learning in the control group and digital learning in the influence group. The significance of differences in post-test scores between the control and training groups was measured using the non-parametric Mann–Whitney test. The outcome of the comparison is depicted in Tables 6 and 7.

Table 3 Summary results from the Wilcoxon test for the difference of pre-test and post-test TTCT-A scores

	Fluency (pre-test/ post-test)	Originality (pre-test/ post-test)	Elaboration (pre-test/ pre-test)	Resistance to premature closure (pre-test/pre-test)	Abstractedness of titles (pre-test/pre- test)
Group A (control), 3–4 years					
Z	-.342 ^b	-.922 ^c	-.577 ^b	-.175 ^b	-.632 ^c
Asymp. Sig. (2-tailed)	.732	.356	.564	.861	.527
Group B (training), 3–4 years					
Z	-3.567 ^b	-3.796 ^b	-3.993 ^b	-3.965 ^b	-3.578 ^b
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000
Group C (control), 5–6 years					
Z	-.428 ^b	-.577 ^b	-.333 ^c	.000 ^d	-.535 ^c
Asymp. Sig. (2-tailed)	.668	.564	.739	1.000	.593
Group D (training), 5–6 years					
Z	-3.771 ^b	-3.488 ^b	-3.341 ^b	-3.971 ^b	-3.789 ^b
Asymp. Sig. (2-tailed)	.000	.000	.001	.000	.000

Table 4 Age-based descriptive statistics for training and control groups' scores on the WPPSI-IV

	FSIQ (pre-test)	FSIQ (post-test)	VCI (pre-test)	VCI (post-test)	VSI (pre-test)	VSI (post-test)	FRI (pre-test)	FRI (post-test)	WMI (pre-test)	WMI (post-test)	PSI (pre-test)	PSI (post-test)
Group A (control), 3–4 years	Mean	85.85	86.85	85.60	88.00	89.40	90.10	85.25	86.95	85.75	88.05	87.50
	Standard error of the mean	.196	.196	.266	.178	.351	.270	.160	.198	.190	.185	.115
	Standard deviation	.875	.875	1.188	.795	1.569	1.210	.716	.887	.851	.826	.513
	Variance	.766	.766	1.411	.632	2.463	1.463	.513	.787	.724	.682	.263
	Skewness	.315	.315	-.159	.000	-.294	.583	-.418	.104	.534	-.098	.432
	Median	86.00	87.00	86.00	88.00	89.50	90.00	85.00	87.00	85.50	88.00	87.50
Group B (training), 3–4 years	Mean	86.15	87.25	85.20	89.55	89.50	91.60	85.15	89.00	85.85	88.25	88.75
	Standard error of the mean	.182	.176	.213	.114	.286	.275	.182	.162	.209	.176	.190
	Standard deviation	.813	.786	.951	.510	1.277	1.231	.813	.725	.933	.786	.851
	Variance	.661	.618	.905	.261	1.632	1.516	.661	.526	.871	.618	.724
	Skewness	-.296	-.496	.375	-.218	-.253	-.068	-.296	.000	.325	-.496	.534
	Median	86.00	87.00	85.00	90.00	89.50	90.50	85.00	89.00	85.50	88.00	88.50

Table 4 (continued)

	FSIQ (pre-test)	FSIQ (post-test)	VCI (pre-test)	VCI (post-test)	VSI (pre-test)	VSI (post-test)	FRI (pre-test)	FRI (post-test)	WMI (pre-test)	WMI (post-test)	PSI (pre-test)	PSI (post-test)
Group C (control), 5–6 years	Mean	86.80	88.70	87.05	88.55	89.65	91.70	86.85	87.95	89.90	88.10	89.95
	Standard error of the mean	.172	.179	.170	.114	.209	.282	.196	.153	.204	.191	.153
	Standard deviation	.768	.801	.759	.510	.933	1.261	.875	.686	.912	.852	.686
	Variance	.589	.642	.576	.261	.871	1.589	.766	.471	.832	.726	.471
Skewness	.372	.627	-.086	-.218	-.055	-.417	.315	.627	.062	.213	-.204	.062
Median	87.00	88.50	87.00	89.00	90.00	92.00	87.00	87.50	88.00	90.00	88.00	90.00
Group D (training), 5–6 years	Mean	86.95	90.45	86.85	89.70	89.20	91.65	86.95	88.20	90.05	87.90	92.55
	Standard error of the mean	.170	.114	.182	.164	.225	.244	.198	.172	.198	.191	.114
	Standard deviation	.759	.510	.813	.733	1.005	1.089	.887	.768	.887	.852	.510
	Variance	.576	.261	.661	.537	1.011	1.187	.787	.589	.787	.726	.261
Skewness	.086	.218	.296	.553	.249	-.564	.104	.788	-.372	-.104	.204	-.218
Median	87.00	91.00	87.00	90.00	89.00	92.00	87.00	90.50	88.00	90.00	88.00	93.00

Table 5 Summary results from the Wilcoxon test for the difference of pre-test and post-test WPPSI-IV scores

	FSIQ (pre-test/post-test)	VCI (pre-test/post-test)	VSI (pre-test/post-test)	FRI (pre-test/post-test)	WMI (pre-test/post-test)	PSI (pre-test/post-test)
Group A (control), 3–4 years						
Z	-2.647 ^b	-3.872 ^b	-1.570 ^b	-3.776 ^b	-3.787 ^b	-3.671 ^b
Asymp. Sig. (2-tailed)	.008	.000	.116	.000	.000	.000
Group B (training), 3–4 years						
Z	-3.156 ^b	-3.959 ^b	-3.428 ^b	-3.949 ^b	-3.971 ^b	-3.962 ^b
Asymp. Sig. (2-tailed)	.002	.000	.000	.000	.000	.000
Group C (control), 5–6 years						
Z	-3.767 ^b	-3.581 ^b	-3.531 ^b	-2.451 ^b	-3.759 ^b	-4.058 ^b
Asymp. Sig. (2-tailed)	.000	.000	.000	.014	.000	.000
Group D (training), 5–6 years						
Z	-3.962 ^b	-3.959 ^b	-3.848 ^b	-3.956 ^b	-3.655 ^b	-3.952 ^b
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.000

Table 6 Results of the statistical significance analysis for differences in the post-test TTCT-A scores

	Fluency	Originality	Elaboration	Resistance to premature closure	Abstractness of titles
Groups A and B (3–4 years)					
Manna-Whitney U	35.500	40.000	.000	.000	65.000
Wilcoxon W	245.500	250.000	210.000	210.000	275.000
Z	-4.568	-4.601	-5.586	-5.550	-4.110
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000
Groups C and D (5–6 years)					
Manna-Whitney U	17.500	51.000	38.500	.000	30.000
Wilcoxon W	227.500	261.000	248.500	210.000	240.000
Z	-5.080	-4.166	-4.633	-5.588	-4.841
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000

Based on TTCT-A findings, the training groups had significantly higher levels of creativity compared to controls. This finding suggests that the use of digital tools can help to enhance creative thinking of younger and older preschoolers.

Regarding cognitive skills, some subscales demonstrated statistically insignificant differences. In the younger group, these subscales were the VCI, FRI, and PSI subscales, and in the older group, these were the FSIQ, VCI, FRI, and PSI subscales.

Table 7 Results of the statistical significance analysis for differences in the post-test WPPSI-IV scores

	FSIQ	VCI	VSI	FRI	WMI	PSI
Groups A and B (3–4 years)						
Manna-Whitney U	148.500	27.000	153.000	17.500	173.000	50.000
Wilcoxon W	358.500	237.000	363.000	227.500	383.000	260.000
Z	-1.480	-4.890	-1.324	-5.075	-.779	-4.386
Asymp. Sig. (2-tailed)	.139	.000	.186	.000	.436	.000
Groups C and D (5–6 years)						
Manna-Whitney U	.000	49.500	187.500	.000	181.500	.000
Wilcoxon W	210.000	259.500	397.500	210.000	391.500	210.000
Z	-5.555	-4.401	-.357	-5.513	-.536	-5.566
Asymp. Sig. (2-tailed)	.000	.000	.721	.000	.592	.000

Future research should focus more on the study of visual-spatial thinking and working memory, for the current course design failed to improve these abilities, and they did not become higher after a series of conventional learning sessions either.

4 Discussion

The results of the study show that digitalization in preschool education significantly improves creative and cognitive development. This conclusion is consistent with, for example, Vygotsky's sociocultural theory of learning (Henderson & Cunningham, 2023). However, it contrasts with traditional views on early education, which prefer direct learning, as evidenced by Piaget's theory of cognitive development (Sidik, 2020). To effectively integrate digital tools into preschools, educators are recommended to consider a blended approach that combines digital and traditional methods, encouraging interactive and child-centered learning. Policymakers can use these findings to develop guidelines that balance the use of technology with traditional teaching methods, creating an adaptive and inclusive learning environment for young children. The current study found that the opportunity to use digital means boosts preschoolers' creative skills, which was explored in many previous scientific works. Some researchers examined whether tablets and smartphones can improve creative skills in preschool children aged 3 to 6 (Behnamnia et al., 2020). Their findings suggest that these devices are capable of developing creative and digital skills, cultivating a positive attitude towards learning among preschool children. Another study explored how mini-games can be used to train the creative thinking of preschool children who were also 3–6 years of age (Xiong et al., 2022). The results showed that the performance of all children improved significantly upon completion of the training. The training itself has proven that digital game-based learning effectively develops preschoolers' creative thinking, which was also established in our study. Likewise, some researchers described the development of the creative abilities among preschoolers through digital technologies and justified the use of such technologies in education (Dongauser et al., 2020).

In this study, results regarding cognitive development are not as clear-cut as in the case of creativity: digital enhancement helped to achieve the same level of skill as the conventional mode of delivery would, and, in cases, to surpass it, but not all cognitive abilities improved to a great extent. A similar research aimed to determine whether a digital educational application designed to mirror an already successful curriculum would be equally effective in developing spatial skills in preschoolers (Bower et al., 2022). The results showed that both concrete and digital spatial training increased performance among children in the experimental group. In addition, the authors report that digital applications are one of the most effective ways of providing children with basic skills. This also demonstrates the effectiveness of digitalization in context of cognitive development. Similarly, another study examined how the ScratchJr application affects the computational thinking, coding, and general literacy skills of young students (Stamatios, 2024). The application was found useful, as it positively affected the development of children's computer literacy and coding skills. A different study (developed digital game-based educational applications filled with content recommended in the Curriculum Guidelines for Pre-School Education (CGPE) (Laranjeiro, 2021). After conducting a preliminary study and post-development evaluation of these applications, the authors found them effective for the development of children's cognitive skills.

Another study compared the impact of two different didactic methods (blended teaching and ICT-based teaching) on the vocabulary development of kindergarten children aged 5–6 (Baltzaki & Chlapana, 2023). Consequently, the authors found that both didactic methods positively influenced the development of children's vocabulary. Such results suggest that using ICT, especially tablet games for vocabulary training in preschool classes is effective, which correlates with the results obtained in our study. In the same way, researchers investigated the effects of digital educational games on cognitive and non-cognitive abilities of first graders (Vanbecelaere et al., 2020). As for cognitive abilities, the results showed that children who played a digital game demonstrated better number line estimation and reading skills. At the same time, no significant differences were observed in digit comparison, letter knowledge, and mathematical competence. In addition, children who played the game performed better on the delayed reading posttest, but not on the delayed math posttest (Vanbecelaere et al., 2020). This shows that digitalization can effectively improve most cognitive skills, but not all of them.

Another publication (Benavides-Varela et al., 2020) focused on a meta-analysis of the effectiveness of digital interventions for students experiencing difficulties in mathematics. A random effects meta-analysis showed that digital interventions improved the overall math performance of students. However, there was significant heterogeneity between studies, and the effect size did not decrease when the interventions were conducted in primary school or preschool. Some study analyzed the impact of multimedia learning and a scientific approach on cognitive development (Yafie et al., 2020). As a result, certain differences between the experimental and control groups were found. Specifically, these differences concerned the average scores for logical thinking, symbolic thinking, and problem solving. The gain score value showed that the experimental group had a higher score than the control group. Consequently, combining multimedia technologies with a scientific approach proved more effective than teaching through a

scientific approach alone. These results also correlate with the current study. Another study examined the impact of educational digital games and classroom games on educational processes among preschool children (Yıldız & Zengin, 2021). The results of the study revealed the absence of significant differences in the development of scientific skills between the two experimental groups. However, both experimental groups outperformed the control group in terms of improving these skills. At the same time, other researchers (Gözen & Cırık, 2017) analyzed the influence of digital storytelling on the socio-emotional behaviors of preschoolers, with an emphasis on verbal and nonverbal interactions and the process of creating narratives. The authors (Gözen & Cırık, 2017) concluded that digital storytelling significantly contributes to the socio-emotional education of children. Although these studies focus on different aspects of technology's impact on children's development, they generally support the current study by providing a comprehensive understanding of digitalization and its influence on the learning and development of preschool children.

5 Conclusions

There were no significant differences between the pre-test and post-test levels of creative thinking among younger and older controls. Therefore, it is safe to assume that conventional preschool learning is not the best choice of the learning format to develop creative abilities, and that additional interventions may be needed. The training groups showed an opposite result: all differences between pre-test and post-test TTCT-A scores were statistically significant within these groups, indicating a higher level of creative ability. This finding suggests that digital tools can be used to foster creativity in both younger and older preschool children. In Group A (younger controls), there were statistically significant differences found between the pre-test and post-test scores on the VCI, FRI, WMI and PSI subscales. In the age-matched training group, the differences were significant for all subscales, which once again emphasized the positive effect of digitalization. Older controls exhibited improvement on all subscales excluding the Fluid Reasoning Index, while 5-to-6-year-olds in the training group showed significant differences for all WPPSI-IV subscales. The post-training VCI, FRI, PSI scores of younger controls were found to be significantly lower compared to their peers in the training group; same is true for older preschoolers, yet, there was also a significant difference in the post-training FSIQ score.

The present study contributes to the existing body of research by providing empirical evidence regarding the boosting effect of digital integration on the creative and cognitive development of preschool children. The results of this study can be used to identify which areas of creative and cognitive development can be improved through digital interventions.

5.1 Limitations

This study has several limitations related to a small sample size. Moreover, the study participants came from the same kindergarten. Another hypothetical limitation is

that teachers, who, despite being professionally trained, could affect the assimilation of knowledge differently. It is also worth mentioning outside factors that could affect the result in one way or another. To improve the understanding of digital tools in preschool education, it is necessary to include a larger and more diverse sample from various preschools in future research. Longitudinal studies are crucial to assess the long-term impact of digital interventions on creative skills and other cognitive abilities. It is important to control the influence of teachers, ensuring the unity of teaching methods throughout an educational institution. In addition, by comparing the effectiveness of various digital tools and methods, additional studies can provide valuable information about optimizing preschool education for creative development. Teaching methods and teacher standardization were used to mitigate teacher bias. Nevertheless, possible influence factors in the study include variations in perceptions of digital resources and individual differences in learning motivation. Additionally, the influence of the home educational environment could have some limitations.

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Data availability All data generated or analysed during this study are included in this published article.

Declarations

Conflict of interests The research has no conflict of interest.

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Enhancing Resilience and Well-Being in Preschoolers with Mandala Art

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ABSTRACT

Objective: The aim of the study was to reveal the effect of mandala art practices on the social-emotional well-being and psychological resilience of three-five-year-old children. **Materials and Methods:** This study was conducted with an experimental research design with a pretest-posttest control group. The participants of the study consisted of 54 children between the ages of three and five attending a kindergarten. While mandala art activities were applied to the intervention group for eight weeks, no intervention was applied to the control group. For data collection, Descriptive Information Form for Children and the Social Emotional Well-Being and Psychological Resilience Scale for Preschool Children were used. SPSS 25.0 program was used to analyze the data and nonparametric tests were applied. **Results:** In the study, it was determined that mandala art practices provided a significant increase in the psychological resilience levels of children in the intervention group. An increase was also achieved in all sub-dimension scores ($p<0.05$). **Conclusion:** The results of the study revealed that mandala art practices are an effective method for strengthening the psychological resilience of children aged three to five years. These findings support the need for more use of art-based practices in fields such as pediatric nursing and early childhood education.

Keywords: Social-Emotional Well-Being, Psychological Resilience, Mandala, Children, Pediatric Nursing.

Mandala Sanatı ile Okul Öncesi Çocuklarda Dayanıklılık ve İyi Olma Halinin Geliştirilmesi

ÖZ

Amaç: Araştırmanın amacı, mandala sanat uygulamalarının üç-beş yaş grubundaki çocukların sosyal-duygusal iyi oluşları ve psikolojik sağlamlıkları üzerindeki etkisini ortaya koymaktır. **Yöntem:** Bu çalışma, ön test-son test kontrol gruplu deneysel bir araştırma tasarımıyla yürütülmüştür. Araştırmanın katılımcılarını bir anaokulda eğitim gören üç-beş yaş arası 54 çocuk oluşturmuştur. Deney grubuna sekiz hafta boyunca mandala sanat etkinlikleri uygulanırken, kontrol grubuna herhangi bir müdahalede bulunulmamıştır. Veri toplamada Çocuklar için Tanıtıcı Bilgi Formu ve Okul Öncesi Çocuklar İçin Sosyal Duygusal İyi Oluş ve Psikolojik Sağlamlık Ölçeği kullanılmıştır. Verilerin analizinde SPSS 25.0 programı kullanılmış ve nonparametrik testler uygulanmıştır. **Bulgular:** Araştırmada, mandala sanat uygulamalarının deney grubundaki çocukların psikolojik sağlamlık düzeylerinde anlamlı bir artış sağladığı belirlenmiştir. Tüm alt boyut puanlarında da artış sağlanmıştır. **Sonuç:** Araştırma sonuçları, mandala sanat uygulamalarının üç-beş yaş grubu çocukların psikolojik sağlamlıklarını güçlendirmede etkili bir yöntem olduğunu ortaya koymaktadır. Bu bulgular, çocuk hemşireliği ve erken çocukluk eğitimi gibi alanlarda sanat temelli uygulamaların daha fazla kullanılması gerektiğini desteklemektedir.

Anahtar Kelimeler: Sosyal-Duygusal İyi Oluş, Psikolojik Sağlamlık, Mandala, Çocuklar, Çocuk Hemşireliği.

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INTRODUCTION

Social-emotional well-being refers to the capacity of individuals to understand themselves and their environment, to cope with emotional difficulties, and to establish a healthy balance in social relationships. For children, this means feeling safe and able to fulfil their emotional needs in interactions with their families, teachers, health personnel and peers (Halle & Darling-Churchill, 2016; Thomson et al., 2021; Xu et al., 2024). This kind of development has a direct impact on children's overall health. Strengthening children's emotional well-being not only enables them to cope with stress in the moment but also supports the development of a healthy personality in the long term (Zins et al., 2004; Eade, 2009).

Psychological resilience refers to the capacity of individuals to cope with stressful and challenging situations in their lives and the ability to emerge from these difficulties with strength (Masten, 2019). Children's psychological resilience affects their ability to cope with trauma or stressful events, and these abilities determine how they will cope with the challenges they face throughout their lives. In this context, psychological resilience in early childhood is critical not only to maintain emotional balance but also to lay the foundation for future psychological and social success (Bethell et al., 2016; Bingöl et al., 2025).

In the early period of children's lives when social-emotional well-being and psychological resilience skills begin to develop, these skills determine the quality of children's interactions with their environment. In this context, supporting these skills at an early age can positively affect children's long-term emotional and psychological development (Masten & Barnes, 2018).

Arts-based approaches offer powerful tools for emotional development and healing. Children can express their feelings that they may not be able to express in words through painting or other artistic activities (Sezince, 2018; Kuru, 2020; Moula, 2021; Moula et al., 2022; Khanna & Rawat, 2024; Fernando & Safitri, 2025). Mandala is one of them. Mandala is an artistic technique widely used especially to help children's emotional and mental recovery. Mandala consists of symmetrical patterns radiating outwards from the centre, and these symmetrical structures can help individuals find their mental and emotional balance (Aykaç, 2020; Kostyunina & Drozdikova-Zaripova, 2016).

Mandala practices can help children cope with stress, anxiety and negative emotional states. Such practices can be used as a therapeutic tool, especially for children who have had challenging or traumatic experiences. Through mandalas, children have the chance to express themselves, provide emotional relief and this process can accelerate their emotional healing process. In addition, mandalas also allow children to focus their attention and find inner peace,

which can help increase their psychological resilience (Aykaç, 2020; Ergür et al., 2021).

The use of techniques such as mandala in art-based therapies not only helps children feel better and achieve emotional balance, but also allows them to develop their emotional intelligence. When children's psychological and emotional development is supported by creative activities, their ability to express themselves and empathise with others is strengthened (Markman, 2020; Wong et al., 2024).

Pediatric nursing, as a field with the task of protecting and improving both physical and psychological health of children, requires nurses not only to perform medical interventions but also to support emotional healing processes (Teksöz & Ocağcı, 2014). Children struggle with emotional distress as well as physical pain during illness processes; therefore, it is important for nurses to use alternative methods such as art-based approaches to support children's emotional recovery (Ding et al., 2021; Buser et al., 2023).

Mandala practices can play an important role in strengthening psychological resilience and emotional healing processes in pediatric nursing. Through mandala activities with children, nurses can better understand the emotional states of children and help them develop skills such as relaxation and coping with stress (Stinley et al., 2015). In addition, art practices such as mandala can reduce the anxiety and fear that children experience while receiving health services and enable them to approach the treatment process more positively (Özsavran & Seval, 2020; Stinley et al., 2015).

The aim of this study is to examine the effect of mandala art practices on social-emotional well-being and psychological resilience among children aged three to five years. It aims to contribute to pediatric nursing practice by revealing how mandala practices have an impact on the emotional and psychological development of children in this age group. In addition, this study aims to emphasise the importance of art-based practices in pediatric nursing and how such practices can be effectively integrated in clinical settings.

In line with this general purpose, the hypotheses of the research are as follows:

H₀= Mandala art practices have no effect on strengthening social-emotional well-being and psychological resilience of three-five-year-old children.

H₁= Mandala art practices have an effect on strengthening the social-emotional well-being and psychological resilience of three-five-year-old children.

The unique value of the study is that it aims to contribute to the literature with the limited number of studies on emotional and psychological development, especially in early childhood, and innovative findings on how art-based therapies can be used more effectively in pediatric nursing practice. By revealing

the potential of mandala practices in strengthening children's psychological resilience, it is expected to contribute to nurses and other health professionals to adopt a broader therapeutic approach in their care processes.

MATERIALS AND METHODS

Study type

The research was carried out as an experimental study with pre-test, post-test control group.

Study time and place

The research was conducted between 11 September 2023 and 1 March 2024. The research was conducted in a university-affiliated kindergarten in a province in the Western Black Sea region of Türkiye. There is one class for each age group. Full-day education service is provided.

Participants

The population of the study consisted of children attending a university-affiliated kindergarten in a city located in the Western Black Sea region of Türkiye. There were a total of 60 children receiving education from this kindergarten. The parents of all students in the kindergarten gave consent for participation in the study. The parents of all the children gave their consent for participation in the study through both verbal and written approval.

In this research, by using G. Power-3.1.9.2 program the sample size of the study was calculated before the data collection phase with 80% theoretical power. For the research, the effect size of 0.55 was calculated based on the study belonging to the sample group "Turkish Music Supported Psychological Resilience Programme: The Effect of Preschool Children on Psychological Resilience Levels" and used as the research effect size. Accordingly, with 95% confidence level, 0.05 alpha value and 0.55 effect size, the minimum number required for a single group in the study was calculated as 23. It was found that 46 participants, 23 in the experimental group and 23 in the control group, would be sufficient.

Since it was thought that there might be participants who might drop out of the study, 30 participants were included in the experimental group and 30 participants were included in the control group. Before starting the study, 2 children from the experimental group and 1 child from the control group got sick. They left before starting the study. One week after the study started, the parents of 1 child in the experimental group and 2 children in the control group reported that their children had given up participating in the study. Therefore, this study was completed with 27 participants in the experimental group and 27 participants in the control group.

At the end of this study, the power of the study was calculated using G. Power-3.1.9.2 program. Accordingly, the difference between the groups in the social emotional well-being and psychological resilience scale for preschool children in the study

was examined. Using the effect size of 2.88, 95% confidence level, 0.05 alpha value, the power of the study was found to be 99%.

The criteria for the inclusion of children in the study are as follows: Being between the ages of 3-5 years, receiving education in kindergarten, the child's parent's acceptance to participate in the study, and the child not having speech, visual and physical disabilities.

Data collection tools

The research data were collected using the Descriptive Information Form for Children and the Social Emotional Well-Being and Psychological Resilience Scale for Preschool Children.

Descriptive information form for children: It is a form that includes questions about demographic information of children such as age, gender, age of parents, educational status, etc.

Social emotional well-being and psychological resilience scale for preschool children : The validity and reliability study of the Social Emotional Well-Being and Psychological Resilience Scale, developed by Mayr and Ulich (2009), was conducted in Türkiye by Özbey (2019). The scale is filled out for each child by his/her teacher on behalf of the child. The scale is a 5-point Likert-type scale and consists of 6 subscales: Communication /Social Performance, Self-Control/Thoughtfulness, Assertiveness, Emotional Stability/Coping with Stress, Task Orientation, Enjoying Exploration. No total score is obtained from the scale. The scores obtained from each of the subscales are evaluated separately. In the Communication/Social Performance subscale of the scale; positive communication, self-expression, making friends, Self-Control/Thoughtfulness subscale; self-control, following rules, respect, courtesy, empathy, thoughtfulness, Assertiveness subscale; assertiveness, self-expression, self-confidence, problem solving, Emotional Stability/Coping with Stress subscale; In the Task Orientation subscale, there are items related to orientation towards the task, fulfilling the given task, concentrating attention, responsibility, and in the Enjoyment of Exploration subscale, there are items related to enjoyment of innovation and exploration, curiosity, optimism, self-confidence, courage and patience. The Pearson Correlation Coefficient between the English and Turkish forms of the scale was found to be between 0.96 and 0.99. The alpha reliability coefficient of the scale is between 0.72 and 0.96 in 36-48-month-old children, between 0.88 and 0.95 in 49-60-month-old children, and between 0.87 and 0.96 in 61-72-month-old children (Özbey, 2019). For this study, reliability analyses were conducted for the subdimensions as follows: Communication/Social Performance (Pre-test: 0.945, Post-test: 0.962, Retention test: 0.955), Self-Control/Thoughtfulness (Pre-test: 0.903, Post-test: 0.913, Retention test: 0.903), Assertiveness (Pre-test: 0.942, Post-test: 0.953, Retention test: 0.954), Emotional

Stability/Coping with Stress (Pre-test: 0.728, Post-test: 0.857, Retention test: 0.835), Task Orientation (Pre-test: 0.874, Post-test: 0.894, Retention test: 0.881), and Enjoyment of Exploration (Pre-test: 0.910, Post-test: 0.936, Retention test: 0.939). The reliability coefficients ranged between 0.728 and 0.962, indicating acceptable to excellent reliability.

Data collection

The mandala art education practices carried out in the kindergarten were given to the children in the experimental group (Figure 1). Questionnaire and scale forms were applied beforehand (Table 1). The scales and questionnaire were filled in by the teachers of the children in the kindergarten. Then, mandala art application training modules were applied (Table 2). Finally, questionnaire and scale forms were applied. One month later, the questionnaire and scale forms were applied again for the retention test.

Data analysis

The data obtained in the study were analysed using SPSS (Statistical Package for Social Sciences) for Windows 25.0 software. Descriptive statistics were used for the information collected from the experimental and control groups. The differences in the descriptive characteristics of the experimental and control groups were determined by Chi-square analysis.

Whether the data used showed normal distribution was tested with Shapiro-Wilk test for groups (n<50)

and Kolmogorov-Smirnov test for the whole variable (n>50). Accordingly, it was seen that the scales did not show normal distribution and nonparametric tests were used.

Mann Whitney U test was used to test whether the scores obtained from two unrelated samples of quantitative variables differed significantly from each other. To test whether more than two dependent groups of quantitative variables differed from each other, Friedman test for repeated measures and Bonferroni multiple comparison test to see from which group the difference originated were applied. Correlation analysis was performed to test the relationship between variables. In the study, p values below 0.05 were considered significant.

Ethical approval

Before starting the study, written permission was obtained from a University Human Research Ethics Committee (Date: 28.03.2023/Number: 099) and the institution where the project would be conducted. Then, an instruction was prepared that the data to be collected before and after the training would be used for scientific purposes within the scope of the research and that the identity information would be kept confidential, and informed consent was obtained from the parents of the children.

Table 1. Study implementation plan.

Stage 1	Creating and finalising training modules and contents	Obtaining expert opinions for the content of the training modules and finalising them (expert opinions were obtained from Child Development Specialist, Art Therapist, Pediatric Nurse, Preschool Education Teacher), training of the researchers on the training content and then the researchers being ready to provide training,
Stage 2	Introduction of the project and invitation to participate in the project	Explanation of the educational aims and objectives, explanation of the educational programme, determination of the expectations of the students and their parents,
Stage 3	Pre-training Measurement	Determination of sociodemographic characteristics and social emotional well-being and psychological resilience levels of all experimental and control group students before the training,
Stage 4	Implementation of training modules	Mandala painting and drawing or different mandala application activities were planned. Trainings were given in one session per week and the training programme ended after eight weeks. At the end of the training, the mandalas made by the children were hung in their classrooms to ensure permanence.
Stage 5	Post-Training Measurement	Determination of social emotional well-being and psychological resilience level of all students after the training,
Stage 6	Retention test	Determination of social emotional well-being and psychological resilience level of all students one month after the training,
Stage 7	Analysing the data	Analysing the data and revealing the findings,

Table 2. Education module.

	Mandala Activity and Description
Week 1	Mandala- Colouring-Game (Children are asked to paint the structured mandala visual in the colours they want).
Week 2	Mandala- Cut and Paste (The pieces of the structured mandala visual are coloured by the children and the children are asked to place them on A4 paper to form a regular visual).
Week 3	Mandala- Show Make (The shapes to be drawn are shown in a way to create a mandala visual and the children are asked to draw them. In this way, the visual is completed).
Week 4	Mandala- Expression of Emotions-Game (Images such as smiley faces, etc., which are expressions of emotions, are placed on the table before drawing. Children are asked to draw and colour the image they want into mandala rings).
Week 5	Mandala - An Icon from Nature (It is possible to see mandala rings or mandala visuals in nature. These are daisies, tree trunks, etc. Children are asked to draw/paint any image that reminds them of the mandala they see in nature).
Week 6	Mandala - The Game (There is an A4 paper in front of each child and the children stand up. The child chooses the one he/she wants from the cut and paste templates they have prepared before and pastes it. In the next stage, they slide to the side and paste the desired shape in front of them on the paper of another friend. This sequence continues until the mandala is completed and there are no more images to paste. Music can be added if desired).
Week 7	Mandala- Dot Connecting (The mandala shapes previously created in the form of dots are created by the children by connecting / drawing / passing over the dots by following the dots).
Week 8	Mandala- Music-Game (It is an activity to be done in the form of transferring what the children feel at that moment in the form of a mandala on paper accompanied by music).

RESULTS

The distribution of the groups participating in the study according to the characteristics is given in Table 3. It was found that 45.5% of the participants in the experimental group were 5 years old, 51.9% were male, 81.5% had siblings, 96.3% of the mother's education was university, 85.2% of the father's education was university, 37.0% of the daily time spent with the mother and father was 2 hours, the

average age of the mother was 36.52, and the average age of the father was 38.15.

In the control group, 51.9% of the participants were 3 years old, 51.9% were girls, 74.1% had siblings, 96.3% had a university education, 81.5% had a university education, 44.4% spent 2 hours a day with their mother and father, the average age of the mother was 31.48, and the average age of the father was 33.70.

Table 3. Distribution of the groups according to descriptive characteristics.

Variables		Experimental group (n=27)		Control group (n=27)		X ²	p
		n	%	n	%		
Age	3,00	6	22.2	14	51.9	5.116	0.088
	4,00	9	33.3	6	22.2		
	5,00	12	44.5	7	25.9		
Gender	Girl	13	48.1	14	51.9	0.074	1.000
	Boy	14	51.9	13	48.1		
Sibling presence	Yes	22	81.5	20	74.1	0.429	0.745
	No	5	18.5	7	25.9		
Mother's education level	High School	1	3.7	1	3.7	0.000	1.000
	University	26	96.3	26	96.3		
Father's education level	High School	4	14.8	5	18.5	0.133	1.000
	University	23	85.2	22	81.5		
Daily time spent by the mother and father with the child	1,00	5	18.5	5	18.5	0.588	0.956
	2,00	10	37.0	12	44.4		
	3,00	9	33.3	8	29.6		
	4,00	3	11.1	2	7.4		
		$\bar{X} \pm SD$	Median (min-max)	$\bar{X} \pm SD$	Median (min-max)	Z	p
Age of mother		36.52±2.44	36 (32-46)	31.48±1.50	32 (29-35)	-6.154	0.000*
Age of father		38.15±2.88	38 (34-48)	33.70±1.68	34 (31-37)	-5.657	0.000*

*p<0.05; X²: Chi-square test; Z:Mann-Whitney

Table 4. Distribution of the groups according to the characteristics related to their artistic activities.

Variables		Experimental group (n=27)		Control group (n=27)		X ²	p
		n	%	n	%		
Interested in art activities	Yes	21	77.8	22	81.5	0.114	1.000
	No	6	22.2	5	18.5		
Applying art activity methods with the child	Yes	24	88.9	20	74.1	1.964	0.293
	No	3	11.1	7	25.9		
Painting	Yes	22	81.5	24	88.9	0.587	0.704
	No	5	18.5	3	11.1		
Dance and movement	Yes	17	63.0	6	22.2	9.164	0.005*
	No	10	37.0	21	77.8		
Music	Yes	18	66.7	12	44.4	2.700	0.170
	No	9	33.3	15	55.6		
Drawing and colouring	Yes	11	40.7	6	22.2	2.146	0.241
	No	16	59.3	21	77.8		
Play game	Yes	18	66.7	13	48.1	1.893	0.271
	No	9	33.3	14	51.9		
Cinema	Yes	4	14.8	2	7.4	0.750	0.669
	No	23	85.2	25	92.6		
Film	Yes	2	7.4	0	0.0	2.077	0.491
	No	25	92.6	27	100.0		
Theatre	Yes	7	25.9	2	7.4	3.333	0.142
	No	20	74.1	25	92.6		
Rhythm practice	Yes	6	22.2	6	22.2	0.000	1.000
	No	21	77.8	21	77.8		
Colouring studies	Yes	13	48.1	8	29.6	1.948	0.264
	No	14	51.9	19	70.4		
Handicraft knitting	Yes	1	3.7	0	0.0	1.019	1.000
	No	26	96.3	27	100.0		
Various other hobbies	Yes	2	7.4	0	0.0	2.077	0.491
	No	25	92.6	27	100.0		
Relaxation through art	Yes	22	81.5	22	81.5	0.000	1.000
	No	5	18.5	5	18.5		

*p<0,05; X²: Chi-square test

Table 4 presents the distribution of the experimental and control groups in terms of their engagement with artistic activities. In both groups, a high percentage of participants reported interest in art and used art activities with children (experimental: 77.8% and 88.9%; control: 81.5% and 74.1%, respectively). Painting was the most common activity in both groups. The experimental group showed higher engagement in dance/movement (63.0% vs. 22.2%), music (66.7% vs. 44.4%), and mandala activities (11.1% vs. 0%). The control group, on the other hand, reported more frequent participation in play activities (48.1% vs. 7%). While theatre, rhythm, and coloring activities were present in both groups to varying degrees, handicraft and other hobbies were scarcely practiced. Notably, 81.5% of participants in both groups reported using art as a way to relax.

The distribution of the social emotional well-being and psychological resilience scale scores of the participants according to the groups and measurements is detailed in Table 5.

It was determined that the pre-test, post-test and retention test communication/social performance dimension scores of the participants in the experimental and control groups showed a statistically significant difference according to the groups (p<0.05). Accordingly, it was seen that the experimental group's pre-test, post-test and retention

test communication / social performance score was greater than the control group. It was determined that there was a statistically significant difference between the measurements of the experimental group's communicating/social performance dimension (p<0.05). Accordingly, the experimental group retention test communication / social performance score is greater than the other measurements. According to multiple comparison, the experimental retention test and post-test communication/ social performance score is greater than the pre-test. It was determined that the post-test and retention test self-control/thoughtfulness dimension score of the participants in the experimental and control groups showed a statistically significant difference according to the groups (p<0.05). Accordingly, it was seen that the experimental group's post-test and retention test self-control/thoughtfulness score was higher than the control group. It was determined that there was a statistically significant difference between the experimental group self-control/thoughtfulness dimension measurements (p<0.05). Accordingly, the experimental group post-test self-control/thoughtfulness score is greater than the other measurements. According to multiple comparison, the experiment retention test and post-test self-control/thoughtfulness score is greater than the pre-

test. It was determined that the post-test and retention test assertiveness dimension scores of the participants in the experimental and control groups showed a statistically significant difference according to the groups ($p < 0.05$). Accordingly, it was seen that the experimental group post-test and retention test assertiveness score was greater than the control group. It was determined that there was a statistically significant difference between the experimental and control group assertiveness dimension measurements ($p < 0,05$). Accordingly, the post-test assertiveness score of the experimental group is greater than the other measurements. Control group pre-test assertiveness score is greater than other measurements. According to multiple comparison, the experimental retention test and post-test assertiveness score is greater than the pretest. Control pre-test assertiveness score is greater than the retention test. It was determined that the pre-test, post-test and retention test emotional stability / coping with stress dimension scores of the participants in the experimental and control groups showed a statistically significant difference according to the groups ($p < 0.05$). According to this, it was seen that the experimental group pre-test, post-test and retention test emotional stability / coping with stress score was greater than the control group. It was determined that there was a statistically significant difference between the experimental group emotional stability/coping with stress dimension measurements ($p < 0,05$). According to this, the post-test emotional stability/coping with stress score of the experimental group is greater than the other measurements. According to multiple comparisons, the post-test and retention test emotional stability/coping with stress scores are higher than the pre-test scores. It was determined that the pre-test, post-test and retention test task orientation dimension scores of the participants in the experimental and control groups showed a statistically significant difference according to the groups ($p < 0.05$). Accordingly, it was seen that the experimental group pre-test, post-test and retention test task orientation score was greater than the control group. It was determined that there was a statistically significant difference between the experimental group task orientation dimension measurements ($p < 0,05$). Accordingly, the experimental group post-test task orientation score is greater than the other measurements. According to the multiple comparison, the experimental retention test and post-test task orientation score is greater than the pretest. It was determined that the participants in the experimental and control groups showed a statistically significant difference in the pre-test, post-test and retention test enjoyment of discovery dimension score according to the groups ($p < 0.05$). Accordingly, it was seen that the pre-test, post-test and retention test enjoyment of discovery score of the experimental group was greater than the control group. It was determined that there was a statistically

significant difference between the experimental group's enjoyment of discovery dimension measurements ($p < 0.05$). According to this, the experimental group post-test enjoyment of discovery score is greater than the other measurements. According to the multiple comparison, the experimental retention test and post-test enjoyment of discovery score is greater than the pre-test. The effect of the groups on communication/social performance was found to be medium in the pre-test (0.70), large in the post-test (1.89), and large in the retention test (2.05). The effect of the groups on self-control/thoughtfulness was found to have a large effect on the post-test (1,47) and a large effect on the retention test (1,70). The effect of the groups on assertiveness was found to have a large effect on the post-test (1,07) and a large effect on the retention test (1,10). The effect of the groups on emotional stability/coping with stress was found to have a large effect on pre-test (0,84), a large effect on post-test (1,79), and a large effect on retention test (1,77). The effect of groups on task orientation was found to have a large pre-test (1.33), a large post-test (2.88), and a large retention test (2.61) effect. The effect of the groups on enjoyment of exploring was found to have a large effect on pre-test (0.98), a large effect on post-test (2.13), and a large effect on retention test (2.04).

DISCUSSION

This study aimed to examine the effects of mandala art activities on strengthening the social-emotional well-being and psychological resilience of three-five-year-old children. The findings show that art-based practices play an important role in children's social-emotional development and are effective in increasing their psychological resilience.

One of the remarkable findings of this study was that mandala art activities increased children's communication and social performance levels. When the pre-test, post-test and retention test scores of the children in the experimental group were analysed, a significant improvement was observed compared to the control group. It is also emphasised by previous studies that art activities help children express their emotions and increase their social interactions (Masten & Barnes, 2018; Oades-Sese et al., 2014). It is seen that mandala art offers children the opportunity to express themselves, contributes to their easier communication in social environments, and thus supports their psychological resilience.

The findings obtained in the dimension of self-control and thoughtfulness are also noteworthy. The significant development of the children in the experimental group in the post-test and retention test shows that mandala art activities support self-regulation skills in children. Jung (2016) stated that mandala art enables individuals to get in touch with unconscious emotions and contributes to the self-regulation process (Jung, 2016).

Table 5. Distribution of participants according to groups and measurements of social emotional well-being and psychological resilience scale.

Variables		Experimental group (n=27)		Control group (n=27)		Test value** and p value	Effect size d
		$\bar{X} \pm SD$	Median (min-max)	$\bar{X} \pm SD$	Median (min-max)		
Communicating/ social performance	Pre-test (1)	22.67±3.46	24 (12-29)	19.37±5.7	21 (9-27)	Z=-2.587 p=0.010*	0.70
	Post-test (2)	27.89±2.68	29 (21-30)	19.48±5.69	21 (8-27)	Z=-5.521 p=0.000*	1.89
	Retention test (3)	27.78±2.79	29 (21-30)	19.37±5.1	20 (10-28)	Z=-5.539 p=0.000*	2.05
	Test Values***	$\chi^2=37.913$		$\chi^2=0.519$			
	p	0.000*		0.772			
	Bonferroni	1<2,3		-			
Self-control/thoughtfulness	Pre-test (1)	24.07±3.5	24 (16-30)	23±4.43	22 (14-29)	Z=-1.017 p=0.309	
	Post-test (2)	28.11±2.29	29 (20-30)	22.78±3.75	22 (15-28)	Z=-5.134 p=0.000*	1.47
	Retention test (3)	27.93±2.38	29 (20-30)	22.81±3.53	22 (15-28)	Z=-5.036 p=0.000*	1.70
	Test Values***	$\chi^2=45.532$		$\chi^2=1.231$			
	p	0.000*		0,540			
	Bonferroni	1<2,3		-			
Assertiveness	Pre-test (1)	23.85±3.06	24 (18-30)	23.37±6,66	25 (9-30)	Z=-1.134 p=0.257	
	Post-test (2)	28.26±1.93	29 (23-30)	23.04±6,6	24 (9-30)	Z=-3.878 p=0.000*	1.07
	Retention test (3)	28.15±2.03	29 (23-30)	22.81±6,59	24 (9-29)	Z=-3.999 p=0.000*	1.10
	Test Values***	$\chi^2=44.617$		$\chi^2=8.400$			
	p	0.000*		0.015*			
	Bonferroni	1<2,3		3<1			
Emotional stability/coping with stress	Pre-test (1)	21.52±2.06	22 (17-24)	19.11±3.5	20 (10-24)	Z=-2.830 p=0.005*	0.84
	Post-test (2)	24.93±2.37	25 (18-29)	19.3±3.75	20 (10-24)	Z=-5.253 p=0.000*	1.79
	Retention test (3)	24.7±2.33	25 (18-28)	19.11±3.8	20 (10-24)	Z=-5.280 p=0.000*	1.77
	Test Values***	$\chi^2=45.023$		$\chi^2=0.036$			
	p	0.000*		0.982			
	Bonferroni	1<2,3		-			
Task orientation	Pre-test (1)	22.19±2.77	23 (14-27)	17.19±4.53	17 (6-24)	Z=-4.427 p=0.000*	1.33
	Post-test (2)	26.15±2.14	27 (22-29)	16.96±3.97	17 (8-21)	Z=-6.331 p=0.000*	2.88
	Retention test (3)	25.67±2.42	26 (22-29)	16.96±4.06	17 (8-22)	Z=-6.257 p=0.000*	2.61
	Test Values***	$\chi^2=36.286$		$\chi^2=2.000$			
	p	0.000*		0.368			
	Bonferroni	1<2,3		-			
Enjoyment of discovery	Pre-test (1)	23.89±1.48	24 (21-28)	20.48±4.69	22 (11-27)	Z=-3.192 p=0.001*	0.98
	Post-test (2)	27.63±2	28 (22-30)	20.26±4.46	21 (12-27)	Z=-5.785 p=0.000*	2.13
	Retention test (3)	27.59±2.08	28 (22-30)	20.3±4.61	21 (12-28)	Z=-5.527 p=0.000*	2.04
	Test Values***	$\chi^2=42.691$		$\chi^2=2.107$			
	p	0.000*		0.349			
	Bonferroni	1<2,3		-			

*p<0.05; **Z:Mann-Whitney; *** χ^2 :Friedman



Figure 1. Mandalas made by children

Mandala studies can reduce children's stress and anxiety levels and encourage them to act by thinking instead of reacting instantly. The development of self-control skills, especially in early childhood, is seen as one of the foundations of academic and social success in later ages (Masten, 2019).

The results obtained in the assertiveness dimension show that mandala art activities increase children's self-expression skills and assertiveness. In the study, it was determined that the assertiveness scores of the children in the experimental group increased significantly. Art-based activities offer an

environment where children have the opportunity to express themselves, develop their creativity and gain self-confidence. Studies have also indicated that art therapy and creative art activities increase children's self-confidence and strengthen their social courage (Kostyunina & Drozdikova-Zaripova, 2016). Mandala art activities are thought to encourage children to be more active in social environments and reinforce their self-confidence.

When evaluated in terms of emotional stability and coping with stress, it is seen that mandala art activities reduce children's stress levels and increase their emotional stability. In the study, it was determined that the experimental group showed a significant improvement in this dimension. In the literature, there are findings that art activities provide individuals to relax mentally by creating meditation-like effects (Ergür et al., 2021). The repetitive, rhythmic and focused structure of mandala works can support children's coping skills with stress and increase their emotional resilience. In this context, it is thought that participation in art activities at an early age may contribute to children to be more resilient against stress factors that they may encounter in later ages.

The findings in the task orientation dimension show that art activities are effective in increasing children's attention span and task orientation. In the study, it was found that the task orientation scores of the children in the experimental group increased significantly compared to the control group. Previous research shows that art activities improve children's attention skills and prolong their focusing time (Cömert & Özbey, 2021). Mandala art activities can improve children's task awareness and responsibility taking skills by enabling them to focus on a task for a long time.

The findings obtained in the dimension of enjoyment of discovery show that art activities increase children's sense of curiosity and desire to explore. It was observed that the enjoyment of discovery scores of the children in the experimental group increased significantly. Art activities support children to be open to trying new things and develop their creative thinking skills (Masten, Gewirtz & Sapienza, 2024). It is thought that art-based practices such as mandala activities encourage children to be open to new experiences and increase their interest in learning.

This research also has important implications for nursing care. Child health nursing is not only limited to physical health but also aims to support the psychosocial development of children (Teksöz & Ocaççı, 2014). Art-based interventions increase children's ability to cope with stress, strengthen their emotional well-being and support their psychological resilience. In this context, it is recommended that creative art therapies such as mandala art activities should be integrated into psychosocial support programmes for children in hospitals and health centres. The use of art-based activities for children receiving long-term treatment in the hospital can

contribute positively to their treatment processes by increasing their emotional well-being (Özsavran & Seval, 2020). In addition, training nurses in art therapy and including these practices in child care processes can offer a more holistic approach in the field of health.

The study has some limitations. The study was conducted in a kindergarten in a specific region and the findings obtained cannot be generalised to a wider population. In addition, the possibility of subjective bias should be taken into consideration since the scales are based on teacher evaluations. In future studies, it is recommended to conduct similar research with larger samples and different age groups. In addition, a comparative study of different arts-based interventions (e.g., music and dance therapy) with mandala may reveal the effects of arts activities on psychological resilience in a more comprehensive manner.

CONCLUSION

In conclusion, this study reveals that mandala art activities are an effective method to strengthen preschool children's social-emotional well-being and psychological resilience. Mandala art activities supported children's social-emotional development and contributed to the development of skills such as coping with stress, self-control, communication, discovery and task orientation. It also emphasises the importance of art-based practices in the field of child health nursing. Therefore, it is recommended to integrate arts-based practices into education and health programmes in early childhood. Strengthening children's psychological resilience at an early age can help them better cope with the challenges they will face in the future.

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Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Plan, design: MÖ, EH; Material, methods and data collection: MÖ, EH, PO, TK, SY; Data analysis and comments: MÖ, EH; Writing and corrections: MÖ, EH.

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Ethical Approval

Institution: Zonguldak Bulent Ecevit University Human Research Ethics Committee

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ORIGINAL ARTICLE

Improving Emotional and Social Development in Preschool Children: Exploring the Effects of Mindfulness-Based Mandala Intervention in Social Work Practice in Macao

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ABSTRACT

The COVID-19 pandemic has posed significant challenges to children's well-being. Mindfulness mandalas, which mobilise attention to the present moment and emphasise the cultivation of here-and-now awareness, have proven effective in adjusting attention and emotions. However, research on the effects of mindfulness-based mandala intervention for children in social work practice, particularly in China, remains inadequate. Using mixed methods and adopting a randomised controlled trial, this study is aimed at exploring the effects of the mindful mandala intervention on improving children's attention and social-emotional competencies. This study involved 16 preschool children in Macao, China, with eight children randomly assigned to the experimental group and eight to the control group. Participants in the experimental group received 8 weeks of mindfulness-based mandala painting intervention, while participants in the control group were treated as usual. The findings revealed that the intervention improved children's attention and social-emotional outcomes across five themes in the experimental group: attention enhancement, emotion awareness, emotion validation, emotion regulation and identifying interrelationships. This study highlights the effects of the mindful mandala intervention in promoting attention and social-emotional development among preschool children. It supports social workers and other mental health professionals in collaborating proactively with educators and caregivers using this technique to mitigate the impacts of the pandemic on children.

1 | Introduction

Over the past 3 years, the COVID-19 pandemic has disrupted home life and preschool programs, posing challenges for young children to participate in optimal learning and social interaction (Murphy, Giordano, and Deloach 2023). In Macao, China, the enforcement of the 'Dynamic COVID-zero' strategy¹, along with stringent pandemic and prevention control measures (i.e., social distancing and school closure), notably affected students' learning (Liu, Liu, and Liang 2022). For example, primary and secondary schools were largely closed in the 2020 Spring Semester,

with multiple instances of closure and reopening occurring across 2021 and 2022. These interruptions forced children to miss out on face-to-face instruction and limited their participation in outdoor activities in the neighbourhoods (Macao Yearbook 2022).

The school closure policy and the shift to remote learning have raised concerns about potential impacts on students' learning outcomes, such as a lack of learning feedback and diminished peer interaction (Dorn et al. 2020; Simpson 2020). Adopting remote learning modalities has led to an increase

in children's use of electronic devices. Excessive use of mobile devices, coupled with inadequate parental supervision, may distract students during online classes. A systematic review examining the effects of screen exposure on attention deficits revealed that such exposure could adversely affect mental health and attention ability (Jourden, Bucaille, and Ropars 2023). Attention deficits may further increase screen exposure (Jourden, Bucaille, and Ropars 2023), potentially serving as the primary indicator of underlying anxiety and depression (APA 2013). Additionally, the increased online learning hours at home may disrupt their daily routines and escalate parent-child conflicts, leading to higher levels of psychological distress among children (Liu et al. 2021).

Moreover, reduced interactions with peers and limited physical activities are detrimental to children's social and emotional development (Gilbert et al. 2021; Saltali 2021). Particularly vulnerable are very young children, whose brains are still in critical stages of development. A national survey conducted during COVID-19 reported that 11.2%–35.2% of 16 094 preschool children across mainland China exhibited emotional and behavioural problems (Wang et al. 2021). Prolonged school closures can heighten psychosocial stress in children (Ma et al. 2022). Exposure to stress, such as separation from significant ones and involvement in complex medical procedures, may lead to the development of trauma and other emotional issues (Jiao et al. 2020; Panchal et al. 2021). Furthermore, growing children may miss out on the nurturing and routine activities provided by early childhood education and care programs, potentially stunting their social-emotional growth and leading to mental health issues (Barnett and Jung 2021; Egan et al. 2021; Sun et al. 2022).

Social work is a core health profession with deep connections to the development of contemporary public health and mental health (Ruth and Marshall 2017). Nowadays, clinical social workers increasingly utilise their clinical knowledge and skills in the assessment and treatment of mental, emotional and behavioural problems to enhance the biopsychosocial functioning of individuals. During COVID-19, social workers have played significant professional roles in promoting clients' psychosocial well-being (Tang et al. 2024). They extend their roles beyond merely relocating social resources and improving access to these resources for children. They also foster parental involvement through coordinated efforts and actively engage in the emotional healing of children using individual and group therapy modalities. Especially in group work practice, social workers often assume the therapist's role, facilitating participants' involvement in structured exercises and interpersonal interactions to promote reflection and insight.

Clinical social workers and other mental health professionals continually seek effective strategies to treat young individuals with emotional and behavioural problems and explore their inner experiences (Wiener and Battles 2002). As such, effective social work practice involves interdisciplinary interventions. Previous research has examined the impacts of various interventions for improving social and emotional ability and attention problems in preschool children (McCabe and Altamura 2011; Nix et al. 2013). Integrating mindfulness and art into social work practice with children is an emerging trend that aims to

improve children's attention and promote their social and emotional development (Bockmann and Yu 2023; Coholic, Schwabe, and Lander 2020; Treves et al. 2023). A related social work practice study on adolescents with mental health issues in Australia implemented an art therapy intervention combining origami and mindfulness techniques, leading to notable improvements in participants' relaxation, motivation, stress, anxiety and overall comfort (Edwards and Hegerty 2018).

Empirical research has substantiated the impact of mindfulness-based art therapy or mandala therapy in reducing psychological difficulties among adolescents, adults and patients (Carsley and Heath 2018; Choi et al. 2021). However, previous research has primarily focused on the psychological and medical fields (Hick and Furlotte 2009), with little focus on younger children. Moreover, the use of mindful mandala techniques for children in China, particularly Macao, has been scarcely explored in prior studies. Therefore, there is a need for empirical evidence to explore the appropriateness of integrating mindfulness and mandala for Chinese preschool children in social work settings.

2 | Research on the Effect of Mindful Mandala Intervention

Mindfulness, a core practice in Eastern Buddhist meditation, has entered the mainstream of modern Western culture for over 40 years after Kabat-Zinn's founding of the stress reduction clinic (Kabat-Zinn 2013). An operational working definition of mindfulness is the nonjudgmental awareness that emerges through intentionally paying attention to the present moment and the unfolding of experience (Kabat-Zinn 2003). A meta-analysis of 21 studies involving children aged 3–12 years has shown that mindfulness-based interventions significantly decreased overall inattention and hyperactivity (Vekety, Logemann, and Takacs 2021). Bockmann and Yu (2023) reviewed 18 studies and indicated that mindfulness programs were beneficial for children in addressing emotional, behavioural and cognitive challenges. Furthermore, higher levels of trait mindfulness may have helped children better cope with various COVID-19 stressors (Treves et al. 2023).

Additionally, mindfulness can aid professionals, including social workers, in increasing self-awareness and emotional regulation, promoting self-care, fostering a sense of social justice and improving communication and collaboration (Hick and Furlotte 2009; McCusker 2020). Integrating mindfulness within social work practice is also developing (McCusker 2020). Research has documented the incorporation of mindfulness interventions across various domains of social work (Garland 2013; Trowbridge and Mische Lawson 2016), aligning well with the core principles of strengths-based and empowerment-focused practices.

Art therapy as a profession originated in the West in the 1940s (Junge 2016). The artwork has been used in social work practice with individuals to promote their subjective experiences (Huss and Sela-Amit 2018), playing a significant role in individual counselling and group therapy settings (Forenza and Eckhardt 2020). Art-based social work encourages individuals' self-expression, promotes their adaptability and gradually

transforms the meanings of traditional symbols and behavioural roles (Forenza and Eckhardt 2020; Huss and Sela-Amit 2018). Through artistic expression, such as drawing, clients can articulate their emotions, feelings and thoughts, thereby facilitating a deeper connection with their inner selves.

This approach is especially beneficial for young children who may not be able to articulate their voices well or whose feelings are obscured. Social workers leverage children's natural inclination to navigate past adverse experiences more swiftly than traditional talk therapy. During art therapy sessions, artistic creation stimulates children's boundless imagination and creativity, positively affecting their concentration and cognitive learning skills (Posner et al. 2008).

One of the artistic creation techniques is the mandala, first proposed by Jung as a method of self-exploration of the soul. Jung (1973) believed that drawing mandalas helps individuals bring thoughts, emotions and concepts into consciousness. As a form of artistic expression, mandala painting encapsulates concepts of wholeness, totality, infinity and unity within its circle, which aligns well with their developmental stage (Jung 1973). It provides a safe space for children to express themselves freely, fostering self-expression, awareness and balance. Thus, preschool children can increase their active participation in experiential expression alongside social workers, broaden their horizons and enhance opportunities for reflection through social worker questioning (Huss and Bos 2022). This approach aids in developing their emotional and social abilities and promotes their ego development through painting (Zakaria, Yunus, and Mohamed 2021). Empirical research has revealed the significant potential of mandala painting, allowing children to achieve a relaxed state to cope with stress and anxiety (Malchiodi 1999; Muthard and Gilbertson 2016; Gürcan and Turan 2021). Furthermore, studies have shown that techniques such as mandala colouring and free drawing are equally effective in reducing anxiety (Jakobsson Støre and Jakobsson 2022).

Integrating mindfulness and art therapy is extensively used in clinical practice with vulnerable children and adolescents in social welfare systems to alleviate psychological distress and behavioural problems, promote academic performance and enhance self-concept (Coholic and Eys 2016; Kim and Kwon 2018). Mindfulness allows children to silently immerse themselves in their art creations, engage in self-exploration and cultivate unique perspectives (Graham and Lewis 2023). Furthermore, mindfulness-based artwork creation captures participants' attention, promotes emotional regulation and offers immersive learning experiences that do not impose a right or wrong way of creating art (Patterson 2015). It can also reduce children's inattention and anxiety and satisfy psychological needs (Malboeuf-Hurtubise et al. 2021). In an evaluation study of mindfulness and art therapy group programs in school settings, findings indicated the programs decreased internalising and externalising symptoms and increased attention in 5–12-year-old children, as rated by parents and teachers (Bokoch and Hass-Cohen 2021). Research has also explored the effects of mindfulness mandala drawing in Western contexts, such as on pain, experiences of inner spiritual connection (Choi et al. 2021; Daudén, Sas, and Potts 2021) and enhancement of well-being in adults (Ozturk and Toruner 2022).

In Chinese culture, there is an enhanced recognition of the importance of social–emotional development in preschool children (Ren and Xu 2019). Mandala painting techniques not only reduce negative emotions but also help to enhance individuals' spirituality and subjective well-being (Liu et al. 2020). Children can freely express themselves, promote self-exploration in a safe space and foster self-growth. Furthermore, studies have unveiled the significant impact of mindfulness-based interventions on improving children's emotional regulation and reducing internalising and externalising problems among Chinese left-behind and migrant children (Lu, Rios, and Huang 2017; Lu et al. 2019). However, research on integrating mindfulness and mandala techniques in preschool children is inadequate, especially in China.

The COVID-19 pandemic has presented social workers in child protection with complex practical challenges (McFadden et al. 2023). Adopting the mindful mandala intervention in social work practice with children has the potential to build a connection with child clients, encourage self-exploration and emotional expression and reduce psychological stress (Malboeuf-Hurtubise et al. 2021). Social workers can utilise mandala drawing to provide a safe space for children to express challenging emotions, thoughts and fears. Integrating mindfulness into this artistic expression can also reduce psychological stress and promote a calming effect on children. Therefore, it is essential to conduct an exploratory study to understand the potential effects of this novel intervention on attention and social–emotional development in preschool children, which will provide valuable insights regarding the most suitable intervention components and approaches for social work practice and further research.

Schools in Macao are equipped with social workers who perform the roles of counselling and psychoeducation. During school closures and reopening, social workers developed intervention programs to address students' issues and support parents. Therefore, taking the example of preschool children in Macao, the primary objective of this study is to investigate the effects of mindfulness-based mandala interventions on enhancing the attention and social–emotional development of preschool children with emotional and behavioural challenges. By doing so, this study is aimed at providing valuable insights for social workers seeking to improve interventions for children with similar emotional health-related issues.

3 | Methods

3.1 | Research Design

This study employed a single-blind, randomised controlled trial (RCT) design to evaluate the effects of mindfulness-based mandala on preschool children at a private coeducational school in Macao from April to June 2022. This intervention lasted 8 weeks and was conducted once a week. While the control group was treated as usual, participants in the experimental group were provided with the mindfulness-based mandala intervention. The mixed-methods study used the Schulte test for children to collect quantitative data regarding children's attention between the pre- and posttests and conducted the qualitative analysis using group session progress notes and

participants' artwork to gain insights into children's experiences during the intervention. The emphasis of this study was to conduct an in-depth analysis of the qualitative data, primarily due to the small sample size. The quantitative data were utilised to provide supplementary evidence and reinforce the qualitative outcomes. This study was approved by the university's Ethical Review Panel.

3.2 | Participants and Data Collection

Eligibility for child participants in this study includes (1) those studying in Kindergarten Level 3 (K3; the third year of preschool education for children aged 5–6 years), (2) those who were reported to have emotional problems by parents or their caregivers and (3) those whose caregivers agreed to participate in this study. We posted the intervention research flyer on bulletins at one school and conveyed the research information to potential participants' caregivers. Caregivers of potential participants could scan the QR code on the poster to fill in the application information. A total of 23 children were recruited for this study. Prior to the intervention, all child participants and their caregivers were fully briefed on the intervention process and the study plan. Informed consent was obtained from parents or guardians by signing a consent form, which included parental consent and authorisation to use children's drawings. They were informed that they could withdraw from the study at any time. Child participants were also asked for their assent to attend a painting group and talk about feelings and emotions to ensure their willingness to participate. Eventually, 16 participants were assessed for eligibility and selected for the study, with eight randomly assigned to the treatment group and eight to the treat-as-usual control group. Identifiable personal information was removed from records and drawings, and pseudonyms were used to protect confidentiality during data analysis.

Most children from the school were from middle- and upper-class Chinese families and spoke Mandarin as their primary language. Of the children, 43.8% were boys, and 56.3% were girls. All child participants were 5 years old. Regarding siblings, 62.5% had no siblings, and 37.5% had one sibling. Half of the children reported using electronic products for an average of 60 min daily, while 37.5% used them for 90 min. About 50% reported having one electronic device, 37.5% had two electronic devices and 12.5% had three electronic devices. Regarding class attendance, over 80% of the children attended all eight sessions during regular class time.

3.3 | Interventions

Child participants in the treatment group received the mindful mandala painting intervention. The intervention was conducted once a week for 8 weeks, with each session lasting 40 min. A maximum of two children were seated at each of the four round tables. Children were required to attend eight group sessions, each consisting of three successive phases.

The first phase involved a 5-min mindfulness exercise. Children were asked to sit comfortably, close their eyes and take a deep breath in and out through their mouths. Then, a simple body

scan was used, beginning at the top of the head and gently moving down through the body, to bring awareness to different body parts (feet, buttocks, waist, head and breath) and feel body sensations. Finally, they were instructed to take deep breaths, check in with their bodies and use their hands to touch the strongest sensations and give themselves a hug.

In the second phase, children were asked to spend about 20 min creating a mandala painting exercise using any drawing material of their choice to connect with the here-and-now moment. To complete the mandala painting, children were instructed to draw a large circle on a white sheet of paper with a colouring pen and then fill it inwards with their chosen drawing materials. The facilitator (a social worker) played soft background music and reminded children not to worry about achieving perfection in mandala painting, as this is not a competition. Instead, they were encouraged to use pens to capture thoughts and feelings through drawing, colouring, or scribbling, as well as stay focused on the present moment throughout the exercise. If children encountered any difficulties during the art-making process, the group facilitator was available to guide them to relax and reduce frustration.

The final phase of each session was a 15-min sharing period, during which children shared their experiences of drawing mandalas and labelled their works with names. Each participant was given time to describe the characters and stories of their artwork to the facilitator. Hinz (2019) suggested that when adults understood and responded to what children expressed in art therapy, children were more likely to engage in the activity and exhibit attention control and self-awareness in imaginative and verbal expressions. As such, the facilitator fulfilled the therapist's role by encouraging children to explore their emotions and thoughts associated with their artwork. The facilitator asked thought-provoking questions in a less threatening way (Springham et al. 2012) to assess children's emotional outcomes during the intervention.

3.4 | Data Collection Tools

Researchers designed and agreed to use procedures to collect and document data about the intervention process. Data collection tools included the Schulte test and semistructured interview outlines.

The Schulte test consists of matrices of 4×4 randomly arranged numbers from 1 to 16 and assesses children's attention levels (Ou et al. 2018). This study adopted the online Chinese free Schulte test (children's version) that could be completed using a touch-screen tablet. The children were instructed to locate numbers in ascending order as quickly as possible, with the response time serving as a measure of their attention level. They have to first find the lowest number (1), then the following lowest number (2), and so on, up to 16. Children with faster completion times exhibit higher levels of attention. Children completed the Schulte tables task before and after completing the 8-week mindfulness mandala to measure their attention levels.

During the group sessions, the facilitator asked child participants to describe their emotional levels using questions that

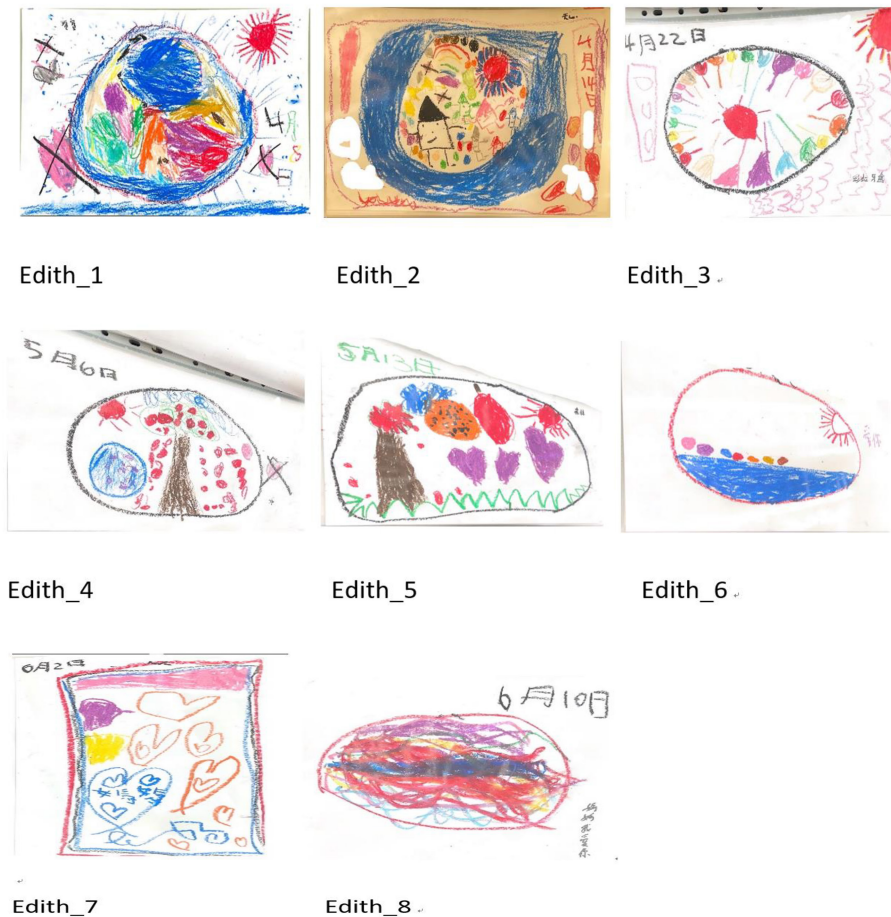


FIGURE 1 | Edith's paintings.

aligned with Chen and Gao's (2016) four dimensions of the therapeutic model of mandala painting. Examples of these questions include 'Can you introduce your artwork?' and 'What does your painting look like?' The facilitator also provided timely positive cues, such as 'Who do you think will help them?' to guide children toward a clear outlook and to express themselves. For example, in Edith's sixth work (as shown in Figure 1), the facilitator asked, 'Did anyone help the caterpillar?' This might lead the participant to reflect on her willingness to help others. The participant then named the painting 'Love You'. Through these interactions, the facilitator guided children toward reshaping positive experiences by encouraging them to reflect on their senses and interactions with others. The facilitator then documented their responses and changes in emotional states before and after painting the mandala. The facilitator also recorded their performance through observation during the treatment to monitor their change over time.

3.5 | Data Analysis

The study employed thematic analysis (TA) to explore the potential impacts of the mindful mandala on emotional and behavioural outcomes. Qualitative data sources were derived from multiple sources, including artwork, observation notes and session notes. The child participants shared their descriptions of the artwork, and the facilitator recorded their experiences, feelings,

emotions and body sensations. A team of four researchers, who have received formal education and practical training in social work and have experience working with children, was responsible for the coding process. The team held discussion meetings to establish the principles of conducting the analysis, which involved describing the paintings of each participant and creating memos, familiarising themselves with therapy and observation notes, identifying social-emotional themes within the data and defining themes (Braun and Clarke 2006).

According to social and emotional development theory (Denham 2006), one researcher, also serving as a facilitator, analysed all paintings of eight participants to identify signs of their emotional awareness and expression and interpersonal relationships and wrote a summary of the overall message conveyed in those paintings. The other two researchers, who received advanced qualitative research training and were not involved in the intervention practice, also independently analysed all children's paintings, focusing on recognising the changes in attention, emotion and social relationships. The team compared three researchers' coding and confirmed the analytical scripts used in conjunction with observation records to gain a deeper understanding of children's emotional and social changes. In cases of disagreement, the team reached a consensus on recognising themes and contents through discussions. Five themes of effect associated with attention, emotional processes and social relationships were identified.

In addition, the study used descriptive statistics to present sample characteristics at baseline. The Wilcoxon matched-pairs signed rank tests were conducted to compare pre- and postintervention profiles between groups to investigate the potential effect on attention.

4 | Research Findings

Children in this study had distinct experiences associated with their family structure or dynamics. For instance, Ace witnessed his parents' divorce and could only visit his mother on weekends. Carr was primarily raised by his grandmother and experienced a lack of parental companionship, resulting in minimal communication with his peers. Edith grew up with a strict father and an estranged mother. Furthermore, six children in this study were only children and lacked playmates within their immediate families. Gill had a 2-year-old brother, and Hedy had a 6-month-old sister, both of whom occasionally competed for their parents' attention and love. These children's parents were occupied with work and often absent from the children's care and companionship. Thus, they were primarily cared for by their grandparents or home helpers. The COVID-19 pandemic further exacerbated the situation, as these children had to stay at home with limited parental companionship and minimal opportunities for peer interaction. The findings of the study revealed five core categories related to the effects of the mindful mandala intervention on attention and social-emotional development.

4.1 | Theme 1: Attention Enhancement

Throughout the 8-week mindfulness-based mandalas intervention, children who initially struggled with maintaining focus during the mindful breathing exercises displayed remarkable improvements in attention. For example, during the initial three sessions, Ace frequently interrupted the sessions by raising questions, creating disturbances and displaying restless behaviour. When the mandala drawing commenced, Ace even asked to use the restroom and exhibited reluctance to adhere to the guidelines. However, a positive change was observed in Ace's behaviour from the fourth session onwards, as he could engage in mindful breathing without distraction and actively participate in the mandala drawing exercises. Similarly, during the first two sessions, Bess occasionally opened her eyes to observe the adherence of other children to the instructions, while Flora exhibited laughter and observed other children. Nonetheless, both girls were able to follow the instructions and draw mandalas afterwards.

In addition, this study used the Schulte test to measure children's attention. As shown in Table 1, the results of a Wilcoxon signed rank test revealed a significant increase in attention scores in the posttest compared to the pretest for the experimental group ($Mdn_{pre} = 54$, $Mdn_{post} = 40.55$, $z = -2.52$, $p < 0.05$). In contrast, no significant difference was found for the control group ($M_{pre} = 56.75$, $M_{post} = 55.5$, $z = -0.70$, $p = 0.483$). The findings suggest that the mindfulness-based mandala painting intervention had a statistically significant effect on attention for children in the experimental group, while no significant effect was found for those in the control group.

TABLE 1 | With-group comparisons of attention using Wilcoxon's matched-pairs signed rank test.

Groups	N	Mdn	Wilcoxon z	p
Preexperimental	8	54	-2.521	0.012**
Postexperimental	8	40.55		
Precontrol	8	56.75	-0.701	0.483
Postcontrol	8	55.5		

Note: Bold indicates statistically significant findings.

** $p < 0.01$.

4.2 | Theme 2: Emotion Awareness

Mindful mandala painting allows child participants to describe their past experiences and explore their underlying or unspoken emotions, such as anxiety and fear. They can connect themselves with emotional awareness by projecting their inner subjective world into the artwork. These emotions, which may be positive or negative, serve as a sign indicating unmet needs or adverse experiences associated with learning challenges or changes in family dynamics under COVID-19. For example, Ace experienced parental divorce and separation from his mother, and a lack of maternal companionship led to his excessive use of electronic devices. Most of his paintings (see Figure 2) are game-themed (squid video game) and associated with the use of electronic devices. His first painting depicted a Wood Man, a character in a South Korean online game, while his fourth untitled one depicted a yellow man holding a gun and trying to target a monster characterised by sharp and colourful teeth. The fifth drawing was titled 'Minecraft', and he told the facilitator, 'I am the red cyborg engaged in combat against green zombies to run underground to dig up the diamonds located on the right.' The eighth painting illustrated the boy as a superman-like figure, striving to evade pursuing green zombies to acquire the gem. These paintings consistently displayed thematic elements such as fighters, zombies, gems and gold necklaces, all derived from Ace's immersion in online gaming experiences. This indicated a significant impact of electronic devices on Ace's worldview. The artwork further revealed a recurring theme of his inner confrontation, as the participant expressed feelings of insecurity and fear through the depiction of his fighting against zombies.

Edith, as an only child, reported experiencing a lack of peer companionship. Her parents were occupied with work and often arrived late to pick her up from school. Her father's strictness and her mother's emotional detachment contributed to Edith's longing for affection and warmth. Previously, a home helper provided care for her, but due to COVID-19 and the helper's departure from Macao, Edith was unable to receive further care, leading to a disruption in her stable attachment relationship and causing distress to her. The sadness expressed in her artwork (see Figure 1) serves as both an emotional expression and a manifestation of her need for deep emotional attachment. The titles of Edith's paintings revolve around themes of family love and emotional expression, including 'A Baby', 'Joy', 'Colourful Teeth', 'Apple Tree', 'Forest', 'Love You', 'Mummy's Love', and 'Mama, I love you'. Edith's paintings also feature heart-shaped patterns;



FIGURE 2 | Ace's paintings.

however, in the first five drawings, the hearts are crossed out, while the last three paintings depict a full heart. Edith explained to the facilitator that the crossed-out hearts symbolise a message of not being disappointed. Edith's mandala drawings highlight her primary emotional need for parental love, and the presence of crossed-out hearts may indicate frustrations in the emotional connection that Edith has experienced.

Mandala paintings also serve as a means for children to convey positive emotions. Flora frequently incorporated heart shapes in her artwork (see Figure 3), often beginning her drawings from the centre, with the central object serving as the main axis or title of the piece. Her first and second paintings depicted scenes from her real-life experiences and joyful moments spent with her family. For example, her first painting portrayed a local landscape with picturesque clouds, the golden sun, flowers and butterflies, which she had visited with her family. Her second painting depicted a Christmas celebration with many heart-shaped lights.

Similarly, Hedy's artwork (see Figure 4) was adorned with love hearts. She titled her first painting 'Love Heart' and the second one 'Love Cat'. In her fourth one, she depicted a beautiful garden, describing a young girl standing on the grass and viewing the beautiful flowers while experiencing happiness. In her eighth painting, she portrayed a birthday party; her grandmother made a delicious cake, and her family and friends celebrated

her birthday in the yard, creating a joy-filled atmosphere. These drawings effectively conveyed their positive feelings, such as happiness, satisfaction and relaxation. When the facilitator asked children to describe their feelings or moods, some children, like Ace, had difficulty expressing emotions accurately in the first three sessions. However, in the last four sessions, Ace was able to convey content in their artwork and articulate emotions more effectively.

4.3 | Theme 3: Emotional Validation

In addition to promoting children's emotional exploration, the mindful mandala also allows them to validate their emotions. During the intervention, the facilitator attempted to help children acknowledge and accept their emotions as meaningful and valid. She asked children to name their paintings, describe their emotional experiences, label their emotions and promote an emotional connection with significant others. Carr's paintings (see Figure 5) did not include himself, his family, friends, or classmates. Instead, he depicted and interpreted his drawings from an outsider's viewpoint, potentially reflecting his emotional state. In the sixth session, Carr drew a 'Rainbow Flower'. The facilitator encouraged Carr to contemplate the relationship between the artwork and real-life events. She asked Carr, 'What is about the painting? How do you feel about your description?' He said, 'This is someone else's house with



Flora_1

Flora_2

Flora_5



Flora_7

FIGURE 3 | Flora's paintings.



Hedy_1

Hedy_2

Hedy_4



Hedy_8

FIGURE 4 | Hedy's painting.



Carr_6

Carr_7

Carr_8

FIGURE 5 | Carr's painting.

flowers inside a vase, and no one was at home at this moment.' He felt alone due to a lack of parental companionship. His seventh painting revealed a picture of going to the park with his

grandmother, his primary caregiver. He disclosed an internal yearning for parental companionship. His eighth painting depicted his father taking him to visit a museum to observe

the planets through an astronomical telescope. He used the metaphor of warm sunlight to describe his feelings. With a heightened and accelerated tone, Carr confidently described that ‘the earth is warm, there are people on it, and I live on it.’ This enthusiastic expression deviated from Carr’s typical sense of excitement. He reflected that his father’s presence and company made him feel warm and powerful.

Similarly, in working with other children, the facilitator encouraged them to label emotions and acknowledge their emotions as valid, as well as provide comfort and acceptance, such as ‘You look really sad’, ‘I feel the way you feel given the situation’ and ‘I am here for you’. Ace’s initial reluctance to engage in the mindfulness practice was observed. Ace expressed his uncertainty and worry about how and what to draw due to the fear of making mistakes. He also revealed negative emotions associated with parental separation and limited contact with his mother. In response, the facilitator validated his emotions—allowing his feelings to be acknowledged at that moment, comforting him to calm down and encouraging him to touch the coloured pens and decide whether to draw. Surprisingly, starting in the fourth session, Ace planned his drawing step by step and followed the rules.

4.4 | Theme 4: Emotion Regulation

Mindful mandala painting also allows children to manage or regulate the intensity and duration of negative emotions using coping strategies. In this study, children identified several emotional regulation skills, including deep breathing, positive self-talk and seeking support. During the 8-week intervention, each participant engaged in mindfulness breathing that synergistically combined mindfulness and self-care. The facilitator tailored this intervention to the developmental level

and characteristics of preschool children by leading them to become aware of their breath and bodies. Children were asked to focus on their body sensations, attend to the tactile experience of their hands touching their bodies and engage in self-embrace. Through this practice, children could establish a connection between feelings and body sensations and acquire the mindful breathing skill to soothe emotions. Most children reported feeling happy, calm, or peaceful after the intervention.

In addition to mindfulness breathing, some children developed an active self-talk strategy and sought help from others. For example, in Edith’s first four paintings (see Figure 1), she portrayed recurring crossed-out heart patterns. She explained that these heart patterns signified ‘not to be disappointed’. Moreover, in Edith’s sixth work, she pictured an injured caterpillar in the blue sea searching for its cut-off tail. However, when the facilitator asked her if someone had helped it, she portrayed the presence of helpers, eliciting feelings of love and gratitude. Under the facilitator’s guidance, she was able to restructure her emotional response and transform negative moods into positive ones. A noticeable change occurred in her paintings, characterised by a decreasing presence of crossed-out heart shapes over time. The seventh drawing stood out with many hearts, featuring 15 hearts of different sizes, larger hearts overlapping smaller ones and interconnected hearts. It notably included three small hearts nested within a large heart, representing ‘mummy’s love’. The fewer crossed-out hearts in subsequent drawings could be interpreted as signs of her ongoing emotional healing process. As a tangible representation of children’s internal psychological state, mandala paintings also serve to evoke positive self-implication. For example, out of Dana’s eight artworks (see Figure 6), six featured a golden sun, symbolising the warmth and brightness that imbued her life.



FIGURE 6 | Dana’s painting.

4.5 | Theme 5: Identifying Interrelationships

Mandala painting facilitates children's exploration of their interrelationships, particularly with significant others such as their parents or peers, which manifests their willingness to build emotional bonds. For example, Ace's sixth work (see Figure 2) portrayed two people on the island: one was Ace, who lived in a colourful room, symbolising that he was resourceful and energetic, and the other was a shadow person in another room. He explained to the facilitator a mutual aspiration to help each other overcome their difficulties and emphasised that interaction and companionship were vital to mutual comfort. Another example is Carr, who conveyed his loneliness and longing for family bonding in a nonverbal way.

The attachment to parents lays a foundation for enhancing children's emotional and social development. Children may attain a close and safe attachment if they build supportive and stable relationships with their parents, which is beneficial for cultivating their capacity for emotional regulation. For instance, Dana (see Figure 6) drew three mandala pictures depicting intimate interaction with her mother. The fifth painting of Dana, titled 'Mom', pertained to a relationship with her mother. She stated that she was standing on a chair while her mother brought back a cake, put it in the freezer and told her to eat it later; they both felt very happy. The eighth picture depicted a little girl engaged in fishing while her mother strolled on the grass, both adorned with warm smiles on their faces. Dana's drawing clearly conveyed a positive relationship and healthy interaction between them. In Edith's paintings (see Figure 1), she expressed the desire for a deeper emotional connection with her parents. In the eighth painting, Edith devoted herself to creating artwork with a blue ocean and dark red colour, conveying the theme of 'I love you, Mum'. In this painting, Edith exuded passionate energy and fully demonstrated a warm connection with her mother.

Besides bonding with parents, children also develop relationships with peers, pets, or others. Gill's paintings (see Figure 7)



Gill_8

FIGURE 7 | Gill's painting.

reflected her approaches to console herself through developing friendships. In her eighth painting, 'Love Heart', she pictured a little girl who had experienced emotional trauma but had now recovered, owing to many friends' support. The fourth painting of Dana showcased her playing with a dog, her closest friend, and conveyed a sense of mutual loyalty and companionship. Nurturing pets can foster children's capacity for caretaking and empathy. In Flora's fifth painting (see Figure 3), she described a boy planting rainbow flowers with the intention of giving them to a girl. Her sixth painting, titled 'Rainbow Love', showcased a boy baking a rainbow cake to sell for charity, and she made a small donation. In the seventh painting, an ant was portrayed playing the piano in a tree, capturing the attention of a giraffe who began dancing upon hearing the music. These mandala paintings convey the interconnectedness and social interactions in children's world.

5 | Discussion

This study has indicated that mindful mandala approaches are beneficial in enhancing children's attention and social and emotional development in early childhood during COVID-19. Examining the effects of mindful mandala techniques contributes to the theory of social-emotional development and its practical application in social work service delivery (Denham 2006). Since the existing literature predominantly emphasises mindfulness-based art therapy, with a limited focus on the outcomes of mindfulness-based mandala interventions on children in the Chinese context (Rieger et al. 2018; Stojcevski et al. 2023), this study offers significant contributions to the current body of literature.

The results of this study identified the following themes: attention enhancement, emotional awareness, emotion validation, emotion regulation and identifying interrelationships. This indicates that the mindfulness-based mandala group intervention allows preschool children under COVID-19 to promote self-awareness; express, validate and regulate negative emotions and gain insights from interrelationships. The findings align with existing similar studies of mindfulness-integrated art interventions on depression, anxiety and inattention among elementary school students (Bokoch and Hass-Cohen 2021; Malboeuf-Hurtubise et al. 2021). The long-term practice of mindfulness and mindful mandala can induce neuroplastic changes that bolster children's capacity to modulate negative emotions and improve cognitive cognitions (Slattery et al. 2022; Xu 2023).

For preschool children, mindful drawing is an appropriate and effective way to stay focused in the present moment, share their understanding of the real world and express their unmet needs and feelings about parent-child or peer relationships (Driessnack 2005). Children in the experimental group recounted experiences associated with life challenges and adversities, demonstrating their abilities to be aware of and express their emotions through mindfulness practice and mindful mandala paintings. Liu et al. (2020) argued that mandala drawing allowed children to externalise negative emotions, thereby establishing a psychological distance from the negative emotions. Under the facilitator's instructions, they could share their

experience and articulate, acknowledge and validate negative emotions. The facilitator also promoted their identification of emotional regulation strategies, such as seeking supporters, practising mindful breathing, engaging in self-positive talk and painting.

During mindfulness practice, attention is at the core of promoting social and emotional awareness (Schonert-Reichl and Lawlor 2010). The quantitative findings of this study suggest that the mindful mandala had a statistically significant effect on attention for children in the experimental group, while no significant effect was found for those in the control group. Based on the facilitator's observation, some of the participants exhibited notable improvements in their attention. The findings align with existing studies that find evidence for the effects of mindfulness (Slattery et al. 2022), mandala painting (Farahani et al. 2023) and mindful mandala intervention (Daudén, Sas, and Potts 2021) on attention. The cognitive process involved in following instructions for mindfulness practice and mandala colouring involves drawing in a circle and using executive functioning and working memory, which are supported by attention processes that enable children to maintain focus on the tasks (Daudén, Sas, and Potts 2021). Therefore, this mind-body connection can integrate motor plans, attention and executive goals to promote children's attention (Clark, Schumann, and Mostofsky 2015).

In future pandemics, mindful mandala intervention, which combines mindfulness and mandala art, can provide a non-verbal form of self-expression for children who may struggle with their difficulties. This intervention can significantly improve attention and self-control and address emotional, behavioural and social challenges (Bockmann and Yu 2023). Social workers can utilise this combined approach to help children practice mindfulness and use artwork to explore their subjective experiences, thoughts, feelings, emotions and body sensations. Mindfulness can be practised anywhere and at any time, while mandala drawing serves as an effective tool for children, especially young children, to convey their subjective experiences, feelings, emotions and insights (Huss and Sela-Amit 2018). Groupwork can also be adopted, allowing children to gain experience, receive feedback from group members and establish social connections.

The facilitator's interactions with participants play a significant role in augmenting children's social-emotional growth. There is no doubt about the essential role that social workers play in promoting children's participation and practice and guiding children to explore, express, validate and regulate emotions (Johnson and McKay-Jackson 2017). In addition to addressing social constraints that children and their families confront, clinical social workers can help them cope with psychosocial challenges (Beckett 2018). Using artwork in social work practice is effective in engaging vulnerable children in a beneficial helping process and allows them to communicate underlying experiences to others and develop self-concept (Coholic and Eys 2016). The shift to the arts also empowers vulnerable children to counteract the verbal dominance of mainstream narratives and express their underlying needs and repressed emotions (Huss and Sela-Amit 2018).

5.1 | Strengths and Limitations

This study advances the current literature on the effects of mindful mandala intervention on Chinese children's attention and social-emotional development. It is also the first effort to identify and explore an effective and accessible intervention approach, mindfulness-based mandala painting interventions, for preschool children with behavioural and emotional problems in Macao, China. This study collected data directly from the children, indicating their real-world and subjective experiences.

However, this study has several limitations. The major limitation is the limited sample size, resulting in a small effect size of this intervention, difficulty in discerning this study's strength and limited generalizability to larger groups of children. Second, this study did not adopt standardised scales to measure the outcomes of children's social-emotional abilities developed through the intervention. Thus, the improvements in children's social-emotional development cannot be adequately captured and measured using a quantitative approach before and after the intervention. However, experience and emotional exploration and expression are critical for growing preschool children, and our study has also demonstrated this effect.

5.2 | Implication for Research

Future studies on mindful mandala intervention should consider expanding the sample size and applying this approach to other groups of children with mental health issues, including school-age children and adolescents. This study was conducted in the Chinese context, indicating that effective practice for children from diverse families should consider cultural differences that may impact how children learn, think and interact with others. Therefore, designing a culturally and age-adapted evidence-based approach is essential to support the effect. Furthermore, an 8-week regular mindful mandala group intervention may have limited effect as the social-emotional development of children is a continuous but slow process. Future intervention research should extend the therapy duration to optimise its effectiveness in enhancing children's social-emotional skills and transforming them into their daily lives to achieve a long-lasting effect using a rigorous experimental design.

5.3 | Implication for Social Work Practice

This study informs social workers to bring mindfulness into practice and design mindful mandala individual or group programs and activities to help children overcome developmental challenges. Children can be guided to maintain their attention, explore the present moment and share their experiences and insights into their body sensations, feelings and emotions. In this way, social workers can approach children's experiences and assist them in identifying effective emotional coping. This study also provides evidence for social workers to support caregivers in utilising mindfulness practice and artwork to improve children's attention and modulate emotions at home.

Furthermore, this study implies that social workers play a vital therapist role in facilitating children's involvement in

mindfulness practice and mindful painting. The benefits of mindfulness practice are contingent on a continuous involvement process (Gotink et al. 2016). Thus, it is significant for therapists to improve their mindfulness skills to effectively facilitate mindfulness practice and ensure the quality of provision (McCusker 2020). Finally, art therapy can be recognised as a valuable intervention strategy in macrosocial work practice to promote children's collective expression and collaboration (Huss and Bos 2022).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Research data are not shared.

Endnotes

¹“Dynamic COVID-zero” is a transitional strategy implanted following a successful containment strategy. It is adopted to identify, control, and treat infected people in each cluster outbreak within a specific geographic region so as to swiftly cut off the transmission chain of the virus (Liu, Liu, and Liang 2022).

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ARTICLES FOR FACULTY MEMBERS

CHILDREN'S SOCIOEMOTIONAL SKILLS

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Mandala coloring reduces anxiety and pain in circumcised children: A randomized controlled trial

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ABSTRACT

Background: Boys often experience significant fear and anxiety before the circumcision procedure, and postoperative pain is linked to increased fear and anxiety in children.

Objectives: The aim of this study was to determine the effect of mandala coloring on fear, anxiety, emotional symptoms and postoperative pain of circumcised children.

Methods: This randomized controlled trial was conducted in the pediatric clinic of a state hospital in eastern Turkey. Children were divided into two groups using a computer program: Group 1 (control) included children with no intervention ($n = 40$), and Group 2 (mandala coloring) included children who received mandala coloring ($n = 38$). Statistical analyses were performed using the Kolmogorov-Smirnov test to assess the normality of the data, the chi-squared test to compare categorical variables between groups, the paired samples t-test for within-group comparisons, the independent samples t-test for between-group comparisons, and mixed model repeated measures ANOVA (rANOVA) to evaluate the temporal changes in pain and anxiety scores across groups. **Findings:** Children's fear, anxiety, emotional symptom, and postoperative pain scores were similar in all groups before the nursing intervention, and the fear, anxiety, and emotional symptom scores of the mandala painting intervention group were statistically lower than the control group after the nursing intervention. The pain scores of the children in the mandala coloring group were lower than the control group after surgery.

Conclusion: Mandala coloring intervention can be used to reduce emotional symptoms, fear, anxiety and postoperative pain in children aged 6–12 years undergoing circumcision.

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Introduction

Circumcision, the surgical removal of the foreskin, is one of the oldest and most common procedures worldwide, performed for religious, medical, cultural reasons, and health benefits in men (Abbott, 2020). It can reduce the risk of urinary tract infections, sexually transmitted infections, and certain cancers (penile cancer, cervical cancer in partner) (Hayashi & Kohri, 2013). However, surgical procedures, including circumcision, are major sources of pain, fear, and anxiety in children (Anwer et al., 2017; Bozdogan Yesilot et al., 2021). Effective pain management is essential, as it reduces postoperative medication use, shortens hospital stays, and improves satisfaction (Frizzell et al., 2017).

In the literature, emphasis is placed on the importance of diverting and relaxing a child's attention (Ramdhanie et al., 2024). Distraction techniques may involve both active and passive methods, such as the

use of puppets, cartoons, balloon blowing, or animation cards (Buyuk et al., 2021; Suzan et al., 2020; Tuncay & Tüfekci, 2023). However, these methods often require technological equipment, and some involve the child's passive participation. In contrast, mandala coloring is a low-cost, easily applicable method that encourages active participation and may be effective in reducing anxiety and pain by enhancing attention focus (Duong et al., 2018; Gebhart et al., 2020). Mandala drawing, which is both an artistic technique and a form of art therapy, helps individuals cope with stress, promotes distraction, enhances creativity, and serves as an ideal method for meditation (Donnalley, 2022; Gürcan & Turan, 2021). This technique increases individuals' awareness, enabling them to adapt to symptoms arising from illness, stress, and traumatic experiences, while also fostering the development of cognitive abilities through the creation of artwork (Carsley & Heath, 2020; Duong et al., 2018; Gebhart et al., 2020). A review of the literature reveals that mandala coloring has been employed as a technique for redirecting attention (Abbing et al., 2018; Cheraghi et al., 2024); however, no studies have been identified in which mandala coloring has been used with children undergoing circumcision. The aim of this

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study was to determine the effect of mandala coloring on fear, anxiety, emotional symptoms, and postoperative pain in circumcised children.

Materials and methods

This randomized controlled trial was conducted to determine the effect of mandala painting on children's fear, anxiety, emotional symptoms, and postoperative pain in children undergoing circumcision operation under general anesthesia in the pediatric clinic of a state hospital in eastern Turkey. Children between the ages of 6 and 12 who could speak and read Turkish, answer questions, and whose legal guardians provided written and verbal consent were included in the study. Children with congenital urological anomalies, those who did not agree to participate, and those who were not within the specified age range were excluded from the study. The flow chart for the formation of groups and random assignment of children to these groups is given in Fig. 1

The sample size for this study was determined using G*Power 3.1.9.7 software. The calculation was based on an F-test for independent groups (ANOVA: repeated measures, within-between interaction). Assuming a medium effect size ($f = 0.25$), a significance level of $\alpha = 0.05$, and a statistical power of $1 - \beta = 0.80$, the required sample size was calculated as 28 participants per group. To account for possible data attrition and to ensure that the assumptions of parametric tests could be met, it was planned to include 40 children in each group.

Randomization

To determine group assignments, a statistician used simple randomization via the website <https://www.random.org/>. Two groups were formed: mandala painting and control. A lottery was used to decide which group would be the mandala painting group and which would be the control. Papers numbered 1 to 80 were placed in opaque envelopes. Parents and children who consented to participate and met the criteria drew an envelope. Participants were assigned to groups based on the number they selected, with each number corresponding to a specific group.

Blinding

Children and their families were not informed of their group assignments. Fear, anxiety, emotional symptoms, and postoperative pain levels were assessed by children ($n = 78$), their parents ($n = 78$), and two independent clinical nurses. Interobserver agreement was checked to ensure consistency across assessments. The researcher (specialist in pediatric nursing) only administered the intervention and provided information about the measures to the nurses but was not involved in data collection. In addition, a statistician independent of the study created the database, performed group coding, and conducted data analysis. This process ensured statistical blinding and reduced the risk of statistical bias.

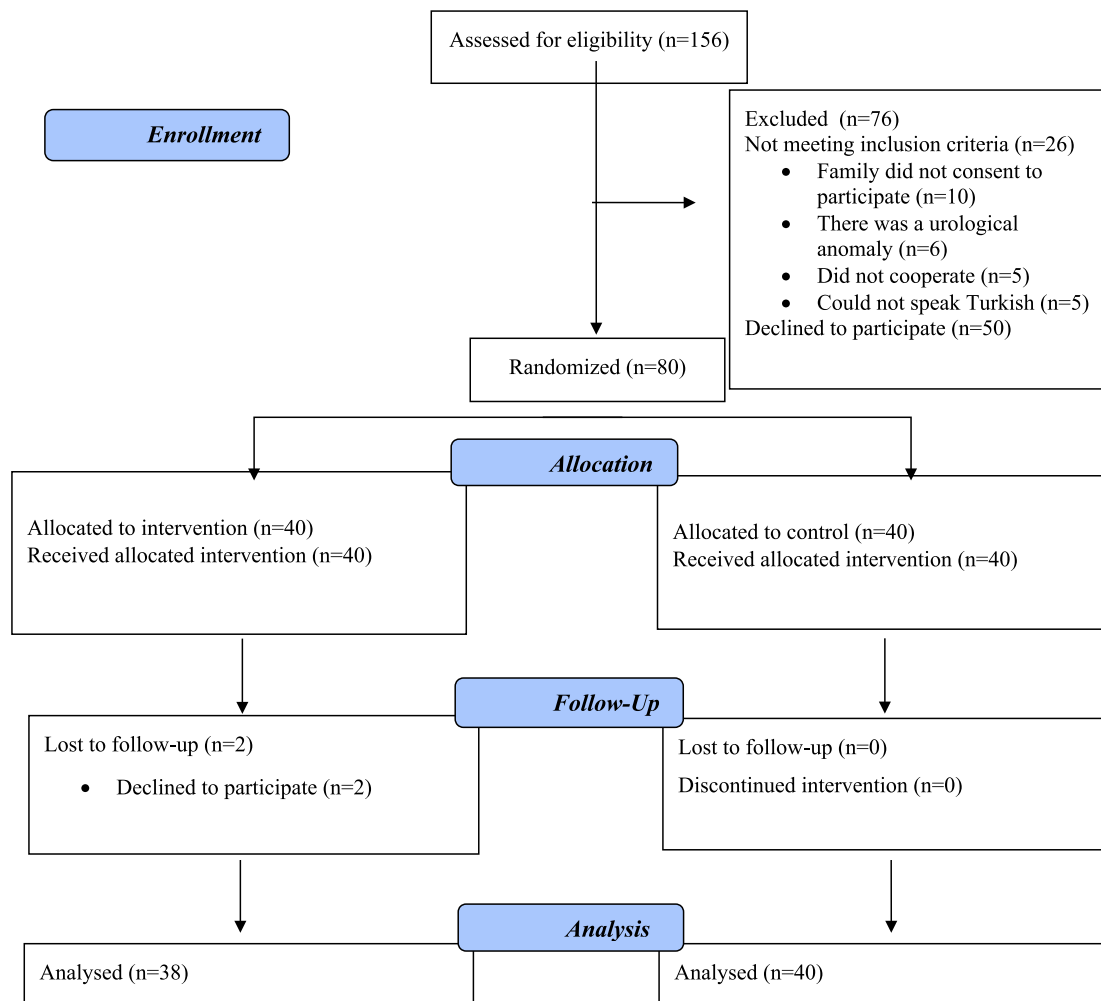


Fig. 1. Consolidated Standards of Reporting Trials diagram showing the flow of participants (study enrollment, randomization, and procedures).

Interventions

The day before the circumcision, children and their families were informed about the study during their hospitalization. After obtaining consent, the child information form was completed 30 min before surgery. All scales, except for the pain scale, were administered to both groups. The mandala coloring group received coloring books and pencils, while the control group received routine care.

The control group had no non-pharmacologic interventions and received routine care before and after surgery. The routine maintenance is as follows: Children scheduled for circumcision are admitted to the clinic one day prior to the surgery. On the day of the procedure, they are taken to the operating room accompanied by nursing staff. The circumcision is performed under general anesthesia, after which the patients are transferred to the pediatric surgery clinic for postoperative monitoring. Children who do not exhibit severe pain or bleeding are discharged and given a follow-up appointment.

In the literature, mandala coloring is reported to be applied in two formats: structured (coloring a pre-designed pattern) and unstructured (creating one's own mandala) (Borzabadi Farahani et al., 2023; Jung, 2017). In this study, the structured mandala coloring method was employed. The intervention was conducted as a single session prior to surgery. In line with similar studies in the literature, each session lasted approximately 30 min (Borzabadi Farahani et al., 2023; Moharamkhani et al., 2023). Before the activity, children were provided with a brief explanation about the mandala coloring task. Subsequently, they were given pre-designed mandala templates along with colored pencils. The mandala coloring was carried out in each child's individual room, allowing them to choose their preferred templates and use the coloring materials See Fig. 2. of their choice. The crayons used were non-toxic, anti-allergenic, and free from carcinogenic substances.

Data collection tools

Child information form

This form, developed by the researchers based on the literature, includes 13 questions regarding the child's age, previous hospitalizations and surgeries, details about the current procedure, sources of information, parents' education levels and occupations, as well as the family's residence and economic status (Suzan et al., 2020; Tuncay & Tüfekci, 2023).

The Wong-Baker Faces pain rating scale (WB-FACES)

This scale was created by Donna Wong and Connie Moran Baker in 1981 (Wong & Baker, 1988). This scale is designed for children aged three to eighteen years. It features facial expressions that are engaging and enjoyable for children, which is said to enhance the accuracy of the results. The scale includes scores of "0," "2," "4," "6," "8," and "10," where "0" signifies the absence of pain and "10" represents the most severe pain. Lower pain tolerance is reflected by higher scores on the scale. Participants are instructed to choose the facial expression that most accurately reflects their current pain level (Wong & Baker, 1988). The WB-FACES scale has been demonstrated to be a reliable and valid assessment instrument within the Turkish population (Tuncay & Sarman, 2024; Tuncay & Tüfekci, 2023). In this research, the scale was utilized not only through the children's self-assessments but also via evaluations conducted by their parents and clinical nurses. Notably, this scale lacks a Cronbach's alpha score, and it has been noted that reliability studies for this type of measurement have not been conducted (Tüfekci & Erci, 2007).

The children's fear scale (CFS)

CFS was employed to evaluate procedural fear in children aged 5 to 10 years. CFS consists of five horizontally arranged facial expressions that represent varying levels of fear, with 0 denoting no fear and 4 indicating the highest level of fear. Prior to using the scale, children received

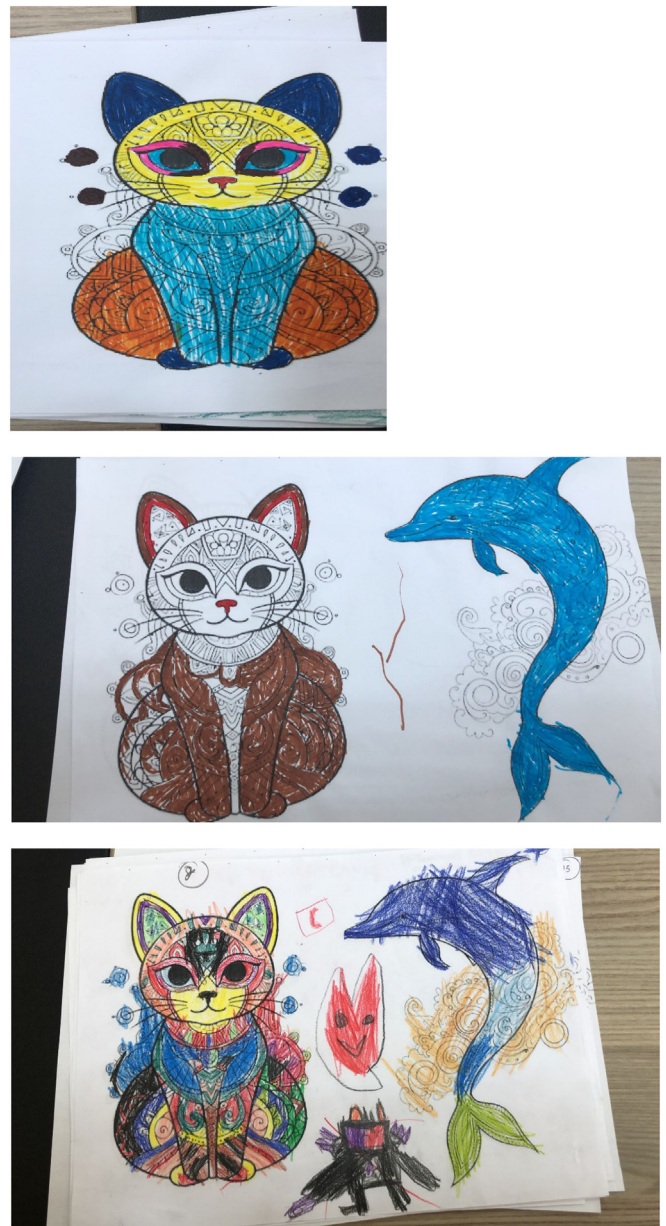


Fig. 2. Example of photos used for the intervention.

instructions on its application and were then asked to select the face that best reflected their fear of circumcision. Their responses were subsequently recorded for analysis (McMurtry et al., 2011). Before the intervention, children received instructions on using the scale, and their understanding was confirmed through feedback. They were then asked to rate their fear of circumcision by selecting one of the provided facial expressions, and their fear level was analyzed based on their choice.

The children's emotional manifestation scale

This scale was developed by Li and Lopez in 2005, offers a straightforward and objective method for nurses to assess emotional behavior and anxiety in children undergoing stressful medical procedures. It targets children aged 7 to 12 and evaluates five dimensions: facial expressions, vocalizations, activity level, interaction, and cooperation. Each dimension is scored from 1 to 5, with higher scores indicating greater negative emotional responses. The total score ranges from 5 to 25 points (Li & Lopez, 2005).

The children's anxiety state scale

This scale was created by Ersig et al. in 2013, is designed to measure state anxiety in children aged 4 to 10 years. The CAS-S (State) is visually represented as a thermometer, featuring a bulb chamber at the bottom and horizontal lines extending upwards, with scores ranging from 0 to 10 points. The bulb chamber indicates 0 points, signifying the absence of anxiety, while movement upward on the scale reflects increasing levels of anxiety, with the highest point, valued at 10, denoting maximum anxiety (Ersig et al., 2013).

Mandala Painting: In this study, a structured mandala coloring activity was employed as a therapeutic intervention to reduce fear, anxiety, and emotional distress before the surgery, and to alleviate pain in the postoperative period. Children were instructed to color pre-drawn mandala patterns, a practice aimed at redirecting their attention away from discomfort, promoting relaxation, and supporting emotional regulation (Bilgin, 2019; Jung, 2017).

Data collection

The day before the circumcision, children and their families were interviewed and informed about the study during hospitalization procedures. After the necessary permissions and consent were obtained, data collection forms and scales (except the pain scale) were administered to both the intervention and control groups. The scales were readministered 30 min later, just 10 min before circumcision. Finally, all scales were reapplied 30 min after returning from the operating room. The pain scale was assessed for both groups immediately and 30 min post-surgery, and the results were evaluated.

Data analysis

Statistical Package for Social Sciences (SPSS) Version 28.0.1.0 was used to analyze the data. Descriptive statistics, including numbers and percentages, as well as mean and standard deviation for numerical variables, were employed. Statistical analyses included the Kolmogorov-Smirnov test, Chi-Square test, Paired Sample *T*-Test, Repeated Measures ANOVA, Independent Sample *T*-Test, mixed model rANOVA, and two-way tests.

Ethical consideration

Prior to the study, ethical committee approval (Date: 27.03.2024 Number: E-95674917- 108.99-245340) and institutional approval were obtained from the hospital where the research was conducted. Written consent was obtained from the parents using the informed voluntary consent form. The study was reported using the child-centred research checklist from the EQUATOR Network (Foster et al., 2025). The trial was registered at <https://clinicaltrials.gov/> (ClinicalTrials.gov identifier: NCT06583187).

Results

A total of 78 children (mean age: 8.06 ± 1.68 years) were enrolled in this study. The percentage of hospitalized children in the experimental group (44.7 %) was higher than in the control group (20 %) ($p = 0.029$). Both groups were homogeneous in terms of place of residence and economic status ($p = 0.785$ and $p = 0.481$, respectively). In addition, the mean age of the children in the control group (8.55 ± 1.64) was higher than in the experimental group (7.55 ± 1.57) ($p = 0.008$) (Table 1).

According to researcher 1, researcher 2 and child reports, the pain scores of the control group did not show a significant decrease after surgery ($p = 0.14$, $p = 0.14$, $p = 0.64$, respectively), while a significant decrease was seen in the experimental group (for all, $p < 0.001$). According to the parent report, there was a significant decrease in pain scores after surgery in both control and experimental groups

($p = 0.016$, $p < 0.001$, respectively). When comparing groups, it was observed that pain reduction was more pronounced in the experimental group for all the reports (for all, $p < 0.001$) (Table 2).

There was no statistically significant difference between the experimental and control groups in before the circumcision measurements ($p > 0.05$). However, comparisons of emotional symptom scores revealed that the mandala coloring group had significantly lower scores than the control group ($p < 0.05$). Researchers noted a significant main effect over time in both groups ($p < 0.001$). Bonferroni tests showed that children in the control group had similar emotional symptom scores 30 min before and after the surgery, with the highest symptoms occurring 10 min before surgery ($T1 > T0 = T2$). In contrast, children in the mandala coloring group exhibited the lowest emotional symptoms before surgery ($T2 > T1 > T0$, Table 3).

There was no statistically significant difference between the experimental and control groups in before the surgery measurements ($p > 0.05$). However, analysis of fear and anxiety scores revealed that the mandala painting group had significantly lower fear scores than the control group after the surgery ($p < 0.001$). Intragroup comparisons showed a statistical difference in time series measurements for both groups ($p < 0.001$). Bonferroni tests indicated that the control group experienced the highest fear and anxiety 30 min after and 10 min before surgery. Conversely, the mandala coloring group reported the lowest fear and anxiety 30 min after the surgery ($T2 > T1 > T0$, Tables 4 and 5).

Discussion

Mandala coloring has recently emerged as a noteworthy intervention due to its positive effects on pain reduction, stress relief, and emotional regulation in children. However, the current literature lacks sufficient data on its potential effectiveness in managing acute stress resulting from medical procedures—particularly in response to common yet potentially traumatic experiences such as circumcision. This gap highlights the significance of our study in addressing an understudied area. Nonetheless, the scarcity of similar research has limited the direct comparison of our findings with previous studies, posing methodological challenges during the discussion process. Therefore, further research is needed in this area.

In the study, it was found that the children in the control and experimental groups did not have preoperative pain and postoperative pain levels increased significantly and the difference between the groups was due to lower pain levels in the mandala painting group compared to the control group (Table 2). No intervention was applied to the children to relieve pain except for painkillers given routinely. However, as a result of statistical analysis, it was determined that the pain of the children in the mandala painting group was lower. However, it is thought that mandala coloring is not an intervention that can directly reduce pain. The reason for this is associated with the decrease in perceived pain due to the decrease in fear and anxiety. Similar to our study, interventions such as “biophilic virtual reality” (Luo et al., 2023), “video animation and puppet intervention” (Tuncay & Tüfekci, 2023), “ventriloquism intervention” (Tuncay & Sarman, 2024) and “tablet-based interactive distraction” (Gezginci et al., 2021) were found to have a positive effect on the child after painful procedures. Reducing anxiety and fear indirectly decreases pain perception by lowering children's sensitivity to pain and their negative expectations. During this process, distraction and relaxation interventions help alleviate both emotional responses and physiological stress reactions, thereby reducing the intensity of perceived pain. Although mandala coloring does not have a direct analgesic effect, it is considered promising for pain management through emotional regulation and cognitive distraction. The combination of psychosocial interventions like mandala coloring with other techniques may further improve pain control in children. This possibility warrants investigation in future studies.

In the study, according to the reports of the researchers, it was determined that the difference between the preoperative and postoperative emotional symptom mean scores of the children in the experimental

Table 1
Demographic and clinical characteristics of children (N = 78).

Categorical Variables		Control Group		Experimental Group		χ^2	p	Cramér's V
		n	%	n	%			
Hospitalization Status	Yes	8	20.0	17	44.7	-	0.029*	-
	No	32	80.0	21	55.3			
Operation Status	Yes	6	15.0	14	36.8	-	0.038*	-
	No	34	85.0	24	63.2			
Informing the Child about the Operation	Yes	35	87.5	32	84.2	-	0.752*	-
	No	5	12.5	6	15.8			
Party Informing the Child	Mother	23	57.5	15	39.5	15.955	0.003**	0.452
	Father	14	35.0	6	15.8			
	Nurse	0	0.0	8	21.1			
	Doctor	1	2.5	2	5.3			
	Other	2	5.0	7	18.4			
Education Level of Mother	Illiterate	4	10.0	1	2.6	17.044	0.002**	0.467
	Literate	0	0.0	1	2.6			
	Primary School	25	62.5	9	23.7			
	High School	8	20.0	19	50.0			
Occupation of Mother	Licence	3	7.5	8	21.1	-	0.006*	-
	Housewife	38	95.0	27	71.1			
	Civil Servant	2	5.0	11	28.9			
Education Level of Father	Literate	0	0.0	1	2.6	11.616	0.009**	0.386
	Primary School	13	32.5	7	18.4			
	High School	22	55.0	13	34.2			
	Licence	5	12.5	17	44.7			
Occupation of Father	Tradesman	10	25.0	1	2.6	10.225	0.037**	0.362
	Barber	1	2.5	2	5.3			
	Driver	1	2.5	1	2.6			
	Civil Servant	9	22.5	17	44.7			
	Freelance	19	47.5	17	44.7			
Place of Residence	Village	2	5.0	1	2.6	0.484	0.785**	0.079
	Town	3	7.5	4	10.5			
	City	35	87.5	33	86.8			
Economic Situation	Good	3	7.5	4	10.5	1.466	0.481**	0.137
	Medium	36	90	31	81.6			
	Bad	1	2.5	3	7.9			
Continuous Variables		Control Group		Experimental Group		t	p †	Cohens's d
Age (years)	n	Mean ± SD	n	Mean ± SD	2.733	0.008†	0.62	

n: number of patients. *There is no Chi-square value since Fisher Exact-test was performed. **Chi-square test, significance level $p < 0.005$. †Independent-Samples t-test, significance level $p < 0.05$.

and control groups was statistically significant (Table 3). The mean pre-operative and postoperative emotional symptom scores of the children in the control group were higher than the mean emotional symptom scores of the children in the experimental group. However, the children in the experimental group showed a greater decrease in the mean post-operative emotional symptom scores according to the researcher's reports (Table 3). This indicates that the emotional symptoms of the children who did mandala coloring were less negative compared to the control group. Studies examining emotional symptoms during

invasive interventions have also found similar results to our study (Burunsuz & Köse, 2020; Li et al., 2016; Yücel & Küçük Alemdar, 2024). Mandala coloring induces a meditation-like effect that reduces stress and anxiety in children, provides a safe medium for emotional expression, and promotes relaxation by diverting attention. Through these mechanisms, positive changes in children's emotional indicators can be observed (Wang & Chia, 2024). Based on all these results, it can be said that mandala coloring positively affects the emotional symptoms of circumcised children.

Table 2
Comparison of pain scores by groups (N = 78).

Pain Variables	Groups	Immadiately after surgery sur		t	p	Cohens's d
		Mean ± SD	30 min. After surgery Mean ± SD			
Researcher 1 report	Control Group	5.38 ± 2.17	6.18 ± 2.26	-2.560	0.14*	0.36
	Experimental Group	5.16 ± 1.52	3.23 ± 1.67	6.783	< 0.001*	1.20
Comparison Between Groups				6.431	< 0.001†	1.87
Researcher 2 report	Control Group	5.38 ± 2.17	6.18 ± 2.27	-2.560	0.14*	0.36
	Experimental Group	5.92 ± 1.81	3.55 ± 1.70	8.757	< 0.001*	1.34
Comparison Between Groups				7.639	< 0.001†	1.83
Child report	Control Group	4.70 ± 2.66	5.35 ± 2.62	-1.908	0.64*	0.24
	Experimental Group	6.55 ± 2.15	3.55 ± 1.93	9.374	< 0.001*	1.46
Comparison Between Groups				7.791	< 0.001†	2.07
Parent report	Control Group	5.48 ± 2.30	6.30 ± 2.33	-2.531	0.016*	0.35
	Experimental Group	6.66 ± 1.88	3.63 ± 1.53	11.183	< 0.001*	1.76
Comparison Between Groups				9.090	< 0.001†	1.88

SD: standard deviation, η_p^2 : partial eta², *Paired-sample t-test, significance level $p < 0.05$. †Independent-sample t-test, significance level $p < 0.05$.

Table 3
Comparison of emotional manifestation scores (N = 78).

Comparison within Groups	T0	T1	T2	F	p*	Bonferroni test	η_p^2
	Mean ± SD	Mean ± SD	Mean ± SD				
Control Group (n = 40)							
Researcher 1 report	8.27 ± 3.01	11.37 ± 2.89	11.17 ± 3.67	52.957	<0.001	T1 > T0 = T2	0.736
Researcher 2 report	8.12 ± 2.96	11.22 ± 2.78	11.15 ± 3.57	57.066	<0.001	T1 > T0 = T2	0.750
Experimental Group (n = 38)							
Researcher 1 report	7.27 ± 2.40	15.68 ± 3.60	9.21 ± 3.39	133.721	<0.001	T2 > T1 > T0	0.881
Researcher 2 report	7.42 ± 2.52	15.57 ± 3.62	9.16 ± 2.98	103.150	<0.001	T2 > T1 > T0	0.851
Comparison Between Groups		Effects of 'Time'		Effects of 'Treatment'		Effects of 'Time x Treatment'	
	F	p†	η_p^2	F	p†	η_p^2	F
Researcher 1 report	172.275	<0.001	0.821	0.570	0.453	0.007	49.795
Researcher 2 report	135.039	<0.001	0.783	0.862	0.356	0.011	42.599

SD: standard deviation, η_p^2 : partial eta², T0: 30 min. Before surgery, T1: 10 min. Before surgery, T2: 30 min. After surgery, *Repeated measures analysis of variance, significance level p < 0.05. †Mixed between-within-subjects' analysis of variance, significance level p < 0.05.

In the study, it was determined that the difference between the preoperative and postoperative fear scale mean scores of the children in the experimental and control groups was statistically significant (Table 4). According to the results of the study, it was determined that the mean scores of the preoperative and postoperative fear scale of the children in the experimental group were lower. However, according to the children's reports in the experimental group, the mean score of the fear scale was higher than in the control group. We can say that this is because fear is a self-report and can vary from child to child. Studies evaluating children's fears during the surgery process support our findings (Ali et al., 2023; Tuncay & Tüfekci, 2023; Türkmen et al., 2022). Children often experience intense fear, anxiety, and stress prior to medical procedures such as surgery. Mandala coloring helps redirect their attention away from these negative emotions by engaging them in a structured activity involving color selection and pattern filling. This distraction-based mechanism can effectively reduce the intensity of perceived fear (Özalp Gerçeker et al., 2020). Based on all these results, it is an indication that mandala coloring, which is one of the techniques to divert attention, will reduce the fear level of children.

In the study, it was determined that a significant difference was found between the preoperative and postoperative anxiety scale mean scores of the children in the experimental and control groups was statistically significant (Table 5). The mean anxiety scale scores of the children in the control group were significantly higher than the mean anxiety scale scores of the children in the experimental group. The studies in the literature provide evidence for our findings (Ali et al., 2023; Firmansyah et al., 2021; Vagnoli et al., 2005). In our study, it is thought

that the reason for the low mean scores of the experimental group on the anxiety scale is the repetitive and structured nature of mandala coloring, which helps to reduce stress and anxiety, and promoting a sense of relaxation and peace.

Limitations

Our study has several strengths, including being the first experimental study to assess the effect of mandala coloring on fear, anxiety, emotional symptoms, and postoperative pain in circumcised children. It used a sufficient sample size and clear scales, with mandala coloring being inexpensive and easy to apply.

However, limitations include conducting the study in a pediatric clinic in eastern Turkey, which limits generalizability. Since the levels of pain, anxiety, and fear assessed in this study are based on subjective self-reports, there is a potential risk of reporting bias. Both children and their parents may have been consciously or unconsciously influenced by their expectations and beliefs regarding the intervention, which could have affected their ratings. Similarly, observer bias may have occurred if those assessing the outcomes held positive preconceptions about the intervention group. This should be acknowledged as a significant limitation of the study.

This study assessed only the short-term effects of the mandala painting intervention, and no follow-up was conducted to examine its long-term impact. This represents a limitation of the study. Future research should include long-term follow-up assessments to evaluate the sustainability and persistence of the intervention's effects.

Table 4
Comparison of fear scores (N = 78).

Comparison within Groups	T0	T1	T2	F	p*	Bonferroni test	η_p^2
	Mean ± SD	Mean ± SD	Mean ± SD				
Control Group (n = 40)							
Researcher 1 report	1.70 ± 1.13	2.93 ± 0.97	2.17 ± 1.13	59.315	<0.001	T1 > T0 = T2	0.757
Researcher 2 report	1.70 ± 1.14	2.97 ± 0.86	2.18 ± 1.13	70.902	<0.001	T2 > T1 > T0	0.789
Child report	1.10 ± 1.35	2.55 ± 1.17	1.90 ± 1.20	49.679	<0.001	T2 > T1 > T0	0.723
Parent report	1.75 ± 1.21	2.93 ± 0.92	2.15 ± 1.21	53.779	<0.001	T2 > T1 > T0	0.739
Experimental Group (n = 38)							
Researcher 1 report	0.76 ± 0.63	2.66 ± 0.97	1.02 ± 0.82	77.876	<0.001	T2 > T1 > T0	0.812
Researcher 2 report	0.79 ± 0.70	2.61 ± 1.00	1.05 ± 0.84	85.781	<0.001	T2 > T1 > T0	0.827
Child report	1.11 ± 0.80	2.95 ± 0.93	1.55 ± 1.13	74.169	<0.001	T2 > T1 > T0	0.805
Parent report	1.00 ± 0.80	2.90 ± 1.20	1.29 ± 1.20	115.091	<0.001	T2 > T1 > T0	0.865
Comparison Between Groups		Effects of 'Time'		Effects of 'Treatment'		Effects of 'Time x Treatment'	
	F	p†	η_p^2	F	p†	η_p^2	F
Researcher 1 report	139.455	<0.001	0.788	24.412	<0.001	0.243	8.937
Researcher 2 report	159.359	<0.001	0.810	25.559	<0.001	0.252	7.022
Child report	123.757	<0.001	0.767	0.009	0.924	0.000	4.038
Parent report	161.736	<0.001	0.812	10.109	0.002	0.117	10.022

SD: standard deviation, η_p^2 : partial eta², T0: 30 min. Before surgery, T1: 10 min. Before surgery, T2: 30 min. After surgery, *Repeated measures analysis of variance, significance level p < 0.05. †Mixed between-within-subjects' analysis of variance, significance level p < 0.05.

Table 5
Comparison of anxiety scores (N = 78).

Comparison within Groups	T0	T1	T2	F	p*	Bonferroni test	η_p^2		
	Mean \pm SD	Mean \pm SD	Mean \pm SD						
Control Group (n = 40)									
Researcher 1 report	8.08 \pm 2.32	9.65 \pm 1.08	0.05 \pm 2.06	20.286	<0.001	T2 > T1 > T0	0.516		
Researcher 2 report	8.08 \pm 2.32	9.65 \pm 1.08	8.05 \pm 2.06	20.286	<0.001	T2 > T1 > T0	0.516		
Child report	7.93 \pm 2.57	9.60 \pm 1.08	7.90 \pm 2.23	20.238	<0.001	T2 > T1 > T0	0.516		
Parent report	8.08 \pm 2.37	9.70 \pm 0.94	8.05 \pm 2.09	22.245	<0.001	T2 > T1 > T0	0.539		
Experimental Group (n = 38)									
Researcher 1 report	2.16 \pm 1.72	4.13 \pm 1.89	2.34 \pm 1.64	63.006	<0.001	T2 > T1 > T0	0.778		
Researcher 2 report	2.16 \pm 1.82	4.26 \pm 2.12	2.31 \pm 1.65	51.437	<0.001	T2 > T1 > T0	0.741		
Child report	2.11 \pm 1.78	4.74 \pm 2.07	2.55 \pm 1.15	67.471	<0.001	T2 > T1 > T0	0.789		
Parent report	2.13 \pm 2.04	4.74 \pm 2.46	2.39 \pm 1.31	42.425	<0.001	T2 > T1 > T0	0.702		
Comparison Between Groups									
	F	Effects of 'Time'		Effects of 'Treatment'			Effects of 'Time x Treatment'		
		p†	η_p^2	F	p†	η_p^2	F	p†	η_p^2
Researcher 1	65.653	<0.001	0.636	636.358	<0.001	0.789	0.542	0.584	0.014
Researcher 2 report	62.850	<0.001	0.626	258.324	<0.001	0.773	0.962	0.387	0.025
Child report	71.145	<0.001	0.655	236.259	<0.001	0.757	2.630	0.079	0.066
Parent report	64.599	<0.001	0.633	251.518	<0.001	0.768	2.693	0.074	0.067

SD: standard deviation, η_p^2 : partial eta², T0: 30 min. Before surgery, T1: 10 min. Before surgery, T2: 30 min. After surgery, *Repeated measures analysis of variance, significance level $p < 0.05$. †Mixed between-within-subjects' analysis of variance, significance level $p < 0.05$.

One limitation of our study is the inability to achieve a homogeneous distribution between the two groups. Nevertheless, this imbalance did not result in any statistically significant differences.

Clinical implications

Mandala coloring is an easy, cheap and accessible intervention that can be implemented by nurses in the clinical setting. In addition, mandala coloring books for all age groups are available for the clinical setting. Future research should investigate the effect of mandala coloring in the hospital process of different types of pediatric post-operation.

Conclusion

This research highlights the significant impact of fear, anxiety, and pain on children's emotional well-being and pain perception. These factors have lasting effects on hospitalization, emphasizing the need for effective interventions. Mandala coloring before circumcision was found to reduce fear, anxiety, emotional symptoms, and postoperative pain. Additionally, parents reported feeling better during the mandala coloring process. Future studies should also assess the impact on parents.

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Ethical consideration

Prior to the study, ethical committee approval (Date: 27.03.2024 Number: E-95674917- 108.99-245340) and institutional approval were obtained from the hospital where the research was conducted. Written consent was obtained from the parents using the informed voluntary consent form. The trial was registered at <https://clinicaltrials.gov/> (ClinicalTrials.gov identifier: NCT06583187).

CRedit authorship contribution statement

Gamze Akay: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Elif Simay Koç:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Formal analysis, Data

curation. **Hatice Oğuzhan:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Formal analysis, Data curation.

Declaration of competing interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Using Mindfulness-Based Interventions to Support Self-regulation in Young Children: A Review of the Literature

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Abstract

The COVID-19 pandemic has caused a rise in stress, mental health concerns, and externalizing behaviors in children and their caregivers across the globe and illuminated the need to reduce stress levels and support self-regulation skills in even the youngest of children. The goal of this literature review is to describe what research has shown about the use of mindfulness-based interventions (MBIs) to support young children's self-regulation in early childhood settings. A total of 18 research studies conducted between 2010 and 2021 were identified. The main purposes of the studies reviewed were to examine the effects of MBIs on the development of emotional, behavioral, and cognitive self-regulation. Results showed that teachers generally found mindfulness practices feasible, acceptable, and effective in their classrooms. Although MBIs were found to have mixed effects on self-regulation in young children, positive effects on self-regulation were significantly greater for children in need of additional support, including those with difficulties or delays in developing self-regulation skills. The current review found a wide variety of MBIs used in early childhood settings globally. The results of this review suggest that teaching mindfulness practices to young children and their caregivers can both support the development of self-regulation of young children and foster socially and emotionally healthy environments in which this development can occur.

Keywords Early childhood · Young children · Mindfulness · Mindfulness-based interventions · Self-regulation

Across the globe, research has revealed the negative impacts of the COVID-19 pandemic on the mental health of young children and their caregivers (Calvano et al., 2021; Gianotti et al., 2021; Imran et al., 2020; Swigonski et al., 2021). The pandemic has caused increases in financial, physical, and mental stress, experiences of depression, and adverse childhood experiences, which have been recorded both at home and in the early childhood education setting. As noted by Kwon et al. (2019), adults' psychological distress and expressed negative moods influence the quality of emotional supports to children and are reflected in children's behavioral problems and difficulties with self-regulation. Thus, in the context of the COVID-19 pandemic, it is essential to develop

tools to support the self-regulation of young children and their caregivers.

Self-regulation is defined as the deliberate use of skills to respond to demands of the environment in a contextually appropriate way and to achieve desired goals (Mentroy et al., 2014). While there are several models to explain how humans self-regulate (Razza et al., 2015; Siegel, 2009; Willis & Dinehart, 2014; Zelazo & Lyons, 2012), common elements of these models include arousal to external stimuli, intentional awareness of this arousal, and deliberate thoughtful response that balances cognition and emotion to act towards a desired goal. More simply, self-regulation is the ability to control one's emotions, body, and attention in order to function and achieve goals and well-being.

Research shows that self-regulation is linked to empathy and conscience development, social competence, overall social and emotional well-being, peer acceptance, and academic success (Janz et al., 2019; Moffitt et al., 2011). In young children, low levels of self-regulation are predictive of disruptive external behaviors (e.g., aggression, impulsive behaviors, defiance), higher rates of rejection and exclusion by peers, more negative commands and redirections from

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teachers (Montroy et al., 2016), poor school readiness and sense of self-worth, lower academic achievement, difficulties managing stress, and high risk for substance abuse and law breaking (McClelland et al., 2013). The National Research Council and Institute of Medicine (2009) identified self-regulation as a risk factor for most mental, emotional and behavioral disorders, and as a protective factor for children with vulnerabilities for externalizing and internalizing disorders. Therefore, self-regulation is critical for success in almost every facet of life. Recent research indicates that digital learning (significantly expanded globally during the pandemic) demands substantial self-regulation skills (Limniou et al., 2021). This finding further emphasizes the need for deliberate and prompt attention to this skill during the early childhood years.

Early childhood is a critical time for the development of self-regulation skills, influenced by language skills, lived experiences, temperament, environment, and genetic inputs. Between the ages of 3 and 7, there is substantial development of the prefrontal cortex, allowing for the development of higher order thinking skills, including executive functioning, effortful control, theory of mind, and empathy (Zelazo & Lyons, 2012), which are all critical for self-regulation development (Razza et al., 2020). Research indicates that most children have foundational self-regulation skills by the end of kindergarten but 35% of children are delayed in their development of self-regulation as much as a year and a half behind their peers (Montroy et al., 2016). After the age of 7, self-regulation develops slowly (Razza et al., 2020), hindering those children who are behind their peers. Thus, the early childhood years must be considered a sensitive period for the development of self-regulation. It is essential to provide programs to support self-regulation in early childhood settings.

While there are various approaches and interventions for teaching self-regulation, mindfulness practices have been recently introduced in educational settings with the goal of promoting wellness and self-regulation in children and teachers. Secular mindfulness, introduced in Jon Kabat Zinn's Mindfulness Based Stress Reduction (MBSR), has been clinically proven to reduce stress, promote self-compassion and empathy, increase both attention (Zenner et al., 2014) and emotional regulation (Goldin & Gross, 2010) in youth and adults. Cultivated through specific contemplative practices, including meditation, breath work, yoga, body scans, and attentional awareness to present moment (Zenner et al., 2014), mindfulness aims to reduce reactivity and judgement of experiences, increase awareness of sensations, feelings, and thoughts, and promote acting with awareness; all skills associated with self-regulation (Brown-Iannuzzi et al., 2014)

Mindfulness-based interventions (MBIs) have been found to both prevent impulsive behavior and interrupt periods of dysregulation. Research indicates that mindfulness enables

cognitive and emotional awareness, diminishes emotional distraction and cognitive rigidity, and allows for intentional regulation of behavior, attention, and emotion (Siegel, 2009; Zelazo & Lyons, 2012). Farb et al. (2012) also found that mindful practices can stop dysregulation by interrupting perseveration on negative thoughts or behaviors, increasing tolerance of difficult emotional sensations, and promoting self-compassion and empathy. Blair and Dennis (2010) further determined that mindfulness allows for a cognitive and emotional rebalance, creating an opportunity for self-regulation. These research studies suggest that overt practice of mindfulness can support self-regulation.

However, the research regarding mindfulness practices and MBIs in school settings have largely focused on older children, adolescents, and adults, (Frank et al., 2015; Greenberg & Harris, 2012; Jennings et al., 2017; Zenner et al., 2014). A literature review by Nieminen and Sajaniemi (2016) described the potential of using MBIs in early childhood settings to support young children. However, their review of mindfulness studies focused on children between 3 and 15 years old with limited information on mindfulness practices for young children such as preschoolers and kindergarteners. Thus, it is critical to examine if mindfulness could be considered an evidence-based practice in early childhood settings. The main goal of the current literature review is to explore what MBIs have been used in early childhood settings and whether the programs were effective for young children's self-regulation development, based on the following three guiding questions: (a) What does the research show about the effectiveness of MBIs in supporting the self-regulation of young children between 3 to 6 years old? (b) What do these findings suggest for future research regarding the use of MBIs in early childhood settings? and (c) What do these findings imply for the use of MBIs with young children to promote self-regulation?

Method

For the purpose of this review, two online databases, Web of Science and ERIC, were independently searched. In the search for articles, keywords *early childhood*, *preschool*, *kindergarten*, *young children*, *mindfulness*, and *self-regulation* were used. The electronic literature search using Web of Science produced 24 research articles. An additional search using ERIC produced 4 more articles. After reviewing abstracts of the 28 articles, studies which met the following criteria were identified for this review: (a) studies that exclusively focused on mindfulness-based interventions (MBI) in early childhood settings that served children between 3 and 6 years old, (b) empirical research studies including measures for self-regulation skills, and (c) studies that were published in peer reviewed journals between 2010 and 2021 and

written in English. Based on these criteria, 13 of 28 articles were removed: 3 articles that did not focus on early childhood settings, 3 literature reviews, 3 articles that were not published in peer reviewed journals, one study published in Spanish only, one study focused on mindful parenting skills, one study that examined the effects of a MBI on perceived discrimination, and one study that focused on participating children's perceptions of self-regulation following a yoga based MBI. Additionally, through a secondary manual search of reference lists in the 15 found articles, 3 additional articles that met the criteria were identified. A total of 18 articles were ultimately selected for this review.

Results

This review begins with an overview of the 18 identified studies. Subsequent sections highlight the findings of the studies reviewed with regards to the effectiveness of MBIs in supporting self-regulation in early childhood education settings.

Overview of the Studies Reviewed

Participants

This review includes 18 studies, published between 2010 and 2021, involving 2,387 children from Australia, Canada, Korea, Singapore, and the United States. Children ranged in ages from 3 to 6. Seven studies (Crooks et al., 2020; Jackman et al., 2019; Lemberger-Truelove et al., 2018; Li-Grining et al., 2021; Poehlmann-Tynan et al., 2016; Thierry et al., 2016; Zelazo et al., 2018) indicated that participants lived in economically disadvantaged communities, and one study recruited participants from a high trauma community (Razza et al., 2020). Though not all studies reported the types of early childhood programs, three studies were conducted in federally funded or subsidized preschools (Li-Grining et al., 2021; Jackman et al., 2019; Poehlmann-Tynan et al., 2016) and one study focused on a university based early childhood center (Wood et al., 2018). Five studies indicated that the majority of the participants were bilingual Hispanic or Latin X children (Lemberger-Truelove et al., 2018; Li-Grining et al., 2021; Moreno-Gómez and Cejudo, 2019; Thierry et al., 2016; Thierry et al., 2018). In summary, the studies reviewed involved diverse participants across socio-economic levels, cultures, and risk factors. See Table 1 for more information about the participants of the reviewed studies.

Study Focus and Measures

All of the 18 studies reviewed examined the effects of MBIs on the participating children's self-regulation (i.e., emotional, behavioral, and cognitive regulations). While almost

all studies (n = 17/18) examined the effects of MBIs on cognitive regulations, 7 studies measured emotional regulation and 11 studies included behavioral regulations. Of the 18 studies, 4 studies measured all three areas of self-regulation and 5 studies focused on only one area. See Table 1 for more details about the targeted self-regulation skills examined across the studies.

In terms of self-regulation measures, researchers used various tools to assess changes in self-regulation following MBIs. The most frequently used measures (n = 14/18) were direct, performance-based assessments such as the *Flanker Fish Task (FFT)* and *Dimensional Change Card Sort (DCCS)* from the *NIH Toolbox of Cognitive Function Battery* (Weintraub et al., 2013), the *Head Toes Knees Shoulders Task (HTKS)* (Ponitz et al., 2008) and *Delay of Gratification Task, also known as the Marshmallow Test*, (Mischel et al., 1972) These tools were administered to participants by trained assessors outside of the classroom setting. For example, the *HTKS* task measured inhibitory control, behavioral regulation and working memory. The *DCCS* and *FFT* measured cognitive flexibility and working memory. In addition to the performance-based assessments, 13 of the studies used teacher questionnaires or rating scales such as *Child Behavior Scale (CBS)* (Merrell, 1996), *Behavior Rating Scales of Executive Function (BRIEF)* (Gioia, et al., 2015), *Strengths and Difficulties Questionnaire (SDQ)* (Goodman, 1997) and *Emotional Regulation Checklist* (Shields & Cicchetti, 1997). These tools were based on teacher observation to measure an assortment of self-regulation skills, including prosocial behavior, emotional regulation, peer relationships, hyperactivity, conduct problems, and effortful control. Seven studies used parental scales and questionnaires such as *SDQ-Parent* (Goodman, 1997), *CBS-Parent* (Merrell, 1996), and *BRIEF-Parent* (Gioia et al., 2015) to measure expressions of self-regulation in the home, as observed by parents. Twelve studies combined both performance-based assessments and teacher or parental rating scales to measure self-regulation before and after MBI.

MBIs for Early Childhood

The studies reviewed revealed a wide array of MBIs used in early childhood classrooms globally. Across the 18 studies reviewed, 15 different models of MBIs were used, sharing a common element of breathwork. The programs varied widely in structure, design, skills taught, frequency of practice, and duration (See Table 2). The following three program trends emerged: Yoga-based MBI, Mind-body awareness, and MBIs combined with social-emotional learning (SEL). Yoga based MBIs (n = 2/18) utilized yoga poses and movement to integrate mindful breath work into the classroom routine. Mind-body awareness focused MBIs (n = 6/18) concentrated awareness on

Table 1 Study focuses and measures

Author & Year of publication	Number of child participants	Study Focus			Measures		
		Emotion Regulation	Behavioral Regulation	Cognitive Regulation	Teacher Observation	Parent Observation	Direct performance based assessments
Razza et al. (2015)	29		X	X		X	X
Flook et al. (2015)	68	X		X	X		X
Poehlmann-Tynan et al. (2016)	29		X	X			X
Thierry et al. (2016)	47	X		X	X	X	X
Lemberger-Truelove et al. (2018)	23		X	X	X		
Lim and Qu (2017)	122			X			X
Wood et al. (2018)	27			X	X	X	
Leyland et al. (2018)	156		X	X		X	X
Moreno-Gómez and Cejudo (2019)	74		X	X	X		X
Thierry et al. (2018)	296			X			X
Viglas and Perlman (2018)	127		X	X	X		X
Zelazo et al. (2018)	218			X	X	X	X
Jackman et al. (2019)	262	X	X	X	X	X	X
Janz et al. (2019)	55	X	X	X	X		X
Crooks et al. (2020)	584	X	X	X	X		
Kim et al. (2020)	83	X	X		X		
Razza et al. (2020)	89			X	X		X
Li-Grining et al. (2021)	98		X	X	X	X	X

physical sensations and on the breath to bring attention to present moment, emotions, and tasks at hand. MBIs combined with SEL components ($n = 10/18$) directly taught metacognition, social and emotional awareness and breathing based mindfulness techniques, to build awareness of emotions, behavior and attention, and social-emotional skills. The component variation revealed in the studies, as well as the variability in duration and frequency of mindfulness practice are worthy of note when considering the effectiveness of MBIs in self-regulation development.

Effectiveness of MBIs on Self-regulation

All 18 studies reviewed examined the effects of MBIs on the participating children's self-regulation skills (e.g., emotional, behavioral, cognitive regulation) using teacher rating scales, parent rating scales, and direct performance-based assessments, as described above. See Table 2 for findings about the effects of the MBIs across the reviewed studies.

Emotion Regulation

Six studies examined the influence of MBIs on emotion regulation with mixed results. Changes in emotion regulation were indicated by increases in awareness of emotions

and self-calming techniques, or decreases in emotional arousal, reactivity arousal, and/or expressed stress. For example, Flook et al. (2015) found significant pre/post change in emotional regulation with a large effect size ($d = 1.22$) for the MBI, but a small effect size ($d = 0.25$) was noted in emotional regulation between the experimental and the control groups. Kim et al. (2020) revealed that while the experimental group scored significantly higher for lability/negativity on the *Emotional Regulation Checklist* than the control group prior to the MBI, following the intervention, the experimental group had significantly reduced lability scores whereas the control group scores increased. The experimental group scored higher in emotional awareness, self-calming, and empathy than the control group following the MBI. These results suggested positive changes in emotion regulation both over time and in comparison to the control group. Several studies showed no statistically significant changes in emotion regulation as measured on direct performance-based assessments (Jackman et al., 2019; Janz et al., 2019; Thierry et al., 2016). However, teacher rating scales in both Jackman et al. (2019) and Janz et al. (2019) indicated positive changes in emotional awareness, self-calming, and internalizing behaviors. These researchers also suggested a possible positive shift in teacher perception of difficult behaviors following MBIs.

Table 2 Intervention characteristics and effectiveness of MBIs in supporting self-regulation

Author & Year	Characteristics			Effectiveness		
	MBI	Duration of MBI	Frequency	Emotion Regulation	Behavioral Regulation	Cognitive Regulation
Razza et al. (2015)	Modified Yoga Kids (Y + MBI)	1 year	Daily	N/A	Yes	Yes
Flook et al. (2015)	Kindness Curriculum (SEL + MBI)	12 weeks	Two 20–30 min lessons, weekly	Yes	N/A	Yes
Poehlmann-Tynan et al. (2016)	Kindness Curriculum (SEL + MBI)	12 weeks	Two 20–30 min lessons, weekly	N/A	Yes	Yes
Thierry et al. (2016)	MindUP (SEL + MBI)	2 years	15-min weekly lessons; breathing practices throughout the day	No	N/A	Yes
Lemberger-Truelove et al. (2018)	Combined SEL&MBI (SEL + MBI)	8 weeks	40-min intervention, 4 times a week	NA	Yes	No
Lim and Qu (2017)	Yoga, meditation, awareness training (Y + MBI)	15 min	Once	N/A	N/A	Yes
Wood et al. (2018)	miniMind (MBA)	6 weeks	Twelve 25-min sessions	N/A	N/A	Yes
Leyland et al. (2018)	Sound in Space (MBA)	3 min	Once	N/A	N/A	No
Moreno-Gómez and Cejudo (2019)	MindKinder (SEL + MBI)	6 months	Six 15-min lessons	N/A	Yes	Yes
Thierry et al. (2018)	Settle your Glitter (SEL + MBI)	9 months	Three daily core breathing practices, 18 lessons taught bi-weekly	N/A	N/A	Yes
Viglas and Perlman (2018)	Mindful Schools (SEL + MBI)	6 weeks	Three 20-min lessons weekly	N/A	Yes	Yes
Zelazo et al. (2018)	Mindfulness + reflection training (MBA)	6 weeks	30 daily lessons	N/A	N/A	Yes
Jackman et al. (2019)	OpenMind (OM) (SEL + MBI)	9 months	Seven daily practices, integrated in school day	Yes	Yes	Yes
Janz et al. (2019)	CalmSpace (MBA)	9 months	Three core practices daily	No	Yes	Yes
Crooks et al (2020)	MindUP (SEL + MBI)	15 weeks	15-min weekly lessons; Multiple daily breathing practices	Yes	Yes	Yes
Kim et al. (2020)	OM-Korea (SEL + MBI)	2 years	Daily guided meditation & 9 mindfulness practices	Yes	N/A	N/A
Razza et al. (2020)	YogaKids (Y + MBI)	9 months	6 times weekly	N/A	Yes	Yes
Li-Grining et al. (2021)	Project CaLM (MBA)	6 months	At least one daily practice for 1 to 5 min	N/A	Yes	Yes

Y + MBI = Yoga based mindfulness intervention, SEL + MBI = MBI combined with social emotional learning, MBA = Mind Body Awareness focused MBI

Yes = effective, No = not effective, N/A = not measured

Behavioral Regulation

Across the 18 studies, 10 studies examined the influence of MBIs on behavioral regulation. Changes in behavioral regulation were measured with decreases in hyperactivity, aggression and behavioral problems, and increases in

impulse control. All of the 10 studies indicated a positive change in behavioral regulation for children who participated in the MBIs. While some reported an overall positive direction of behavior change (Li-Grining et al., 2021; Wood et al., 2018), other studies revealed reductions in conduct and behavioral problems, including hyperactivity and

aggression (Crooks et al., 2020; Janz et al., 2019; Moreno-Gómez and Cejudo, 2019), as indicated in teacher rating scales and reports. Several researchers also found significant increases in behavioral regulation and behavior control after their participation in MBIs (Lemberger-Truelove et al., 2018; Poehlmann-Tynan et al., 2016; Razza et al., 2020). Specifically, Lim and Qu (2017) demonstrated that a 15-min mindfulness activity (e.g., breathwork, yoga, sensory awareness) was effective for children to stop an automatic impulsive response and to choose a more intentional and deliberate response.

Cognitive Regulation

Almost all studies reviewed ($n = 17/18$) measured cognitive regulation and those studies found that MBIs had positive effects on cognitive self-regulation in young children. Changes in cognitive regulation were indicated by increases in attention, executive functions, including inhibitory control, cognitive flexibility and working memory. The use of MBIs in early childhood settings led to decreases in executive function deficits (Crooks et al., 2020), increases in cognitive flexibility and inhibitory control (Flook et al., 2015), attention regulation (Li-Grining et al., 2021; Janz et al., 2019; Razza et al., 2015; Razza et al., 2020; Viglas & Perlman, 2018), and moderate reductions in academic problems (Moreno-Gómez and Cejudo, 2019). All these studies suggest that mindfulness practices with young children have potential to support the development of cognitive self-regulation by fostering awareness, cognitive flexibility, inhibitory control, and executive functions.

Children with Additional Challenges

Across the studies reviewed, MBIs were found to be especially impactful with children whose temperament, social-emotional skills, domestic circumstances (i.e., economic instability, chronic stress, or trauma experience) or learning differences may result in difficulties achieving success in school settings. Several studies showed that those children with lower levels of executive function (Flook et al., 2015), lower self-regulation and difficulties with social skills (Viglas & Perlman, 2018), hyperactivity and attention deficits in clinical range (Janz et al., 2019) and high social risk indicators and higher levels of behavioral challenges (Crooks et al., 2020) had the highest levels of change in self-regulation skills following MBIs. Thierry et al. (2016) revealed that children in the control group who spoke Spanish at home but were taught in English showed a loss in executive function skills over time, but those who participated in a MBI did not have the same loss of executive function skills. These findings suggested that the MBIs supported executive functions in circumstance of greater cognitive challenge for

young children. Finally, Kim et al. (2020) found that children with overall lower levels of self-regulation skills prior to the MBI surpassed the scores of the control group at the post intervention measurements. These studies suggest that while mindfulness-based interventions and practices may have a positive effect on all children, the effect may be most significant for those who are struggling to develop behavioral, cognitive, and emotional self-regulation skills.

Duration and Frequency of MBIs

As noted in Table 2, the MBIs used in the reviewed studies varied widely in their duration and frequency. Overall, results from the studies suggest that duration of an intervention is related to the effectiveness of interventions. Lim and Qu (2017) found that a single session MBI changed the attentional scope of 4- to 6-year-old children, de-automatizing their responses, and thus promoting attention and behavior control, but did not achieve long term change. Leyland et al. (2018)'s study involving a single mindfulness "induction" did not effect change in executive functioning. Longer duration and higher frequency of MBIs led to greater benefits. For example, MBIs taught over the 6 to 12-week periods had positive effects on children in the intervention groups compared to the control groups (Flook et al., 2015; Poehlmann-Tynan et al., 2016; Viglas & Perlman, 2018; Wood et al., 2018; Zelazo et al., 2018). Longer mindfulness interventions similarly led to even greater improvements in children's executive functions, self-awareness, and self-regulation compared to children in the control groups. Studies that implemented MBIs for the full academic year also showed positive effects for the intervention groups (Jackman et al., 2019; Kim et al., 2020; Razza et al., 2015, 2020; Thierry et al., 2016, 2018). Thierry et al. (2016) followed children in a multiyear MBI, in which mindfulness practices were integrated into the daily schedule of the classroom over two years. The study revealed that the MBI was effective for promoting emotional and cognitive self-regulation as well as higher vocabulary scores and reading scores.

Parent Involvement

Parent involvement in the studies reviewed was limited. Only Jackman et al. (2019) included a component for training parents in the use of mindfulness practices at home, and participation level in this training was noted as low. Several studies included parent ratings in addition to teacher ratings in measures of self-regulation (Crooks et al., 2020; Jackman et al., 2019; Li-Grining et al., 2021; Wood et al., 2018; Zelazo et al., 2018), though low levels of completion of these rating scales were reported. Notably, discrepancies were found between parent ratings and teacher ratings in terms of changes in children's self-regulation after their

participations in MBIs. Possible explanations for these discrepancies may include that self-regulation growth may not have generalized to the home environment, potential bias on the part of teachers who were responsible for implementing the intervention, or lack of knowledge of skills and language of mindfulness and thus inability to reinforce the use of mindfulness techniques at home. In addition to parent ratings for self-regulation measures, several researchers asked parents to complete the social validity measures of MBIs, which all showed overall positive results (Kim et al., 2020; Li-Grining et al., 2021; Wood et al., 2018). For example, in Li-Grining et al., 14 of 15 parents expressed interest in learning and implementing mindfulness practices in the home.

Discussion

Results from the studies reviewed demonstrated that over time, with practice and integration, mindfulness programs can support the development of self-regulation in young children, particularly cognitive regulation, but emotional and behavior regulation as well, with potential academic benefits. Research indicates that mindfulness programs particularly help children who face additional economic, domestic, temperamental, behavioral, or cognitive challenges, as these children consistently exhibited the most growth from MBI programs. The plethora of MBI in use reflects a demand for mindfulness programs across age groups. Teachers who use mindfulness programs, both those with experience and those for whom the practices are a novelty, find the programs feasible, acceptable, and desirable. Teachers also report that the programs help their children show more prosocial behaviors, use more kindness language and actions, and be more aware and empathetic (Flook et al., 2015; Jackman, et al., 2019), thus improving the overall atmosphere in the classroom. As previous research has indicated, mindfulness supports the mental health and emotional regulation of teachers, providing a healthier classroom environment for all children.

Related to the effectiveness of MBIs, the majority of the reviewed studies ($n = 15/18$) reported on the social validity and feasibility of MBIs. Several researchers measured the social validity based on participating parents' reports, which indicated desirability and acceptability of MBIs (Kim et al., 2020; Li-Grining et al., 2021; Wood et al., 2018). Jackman et al. (2019) showed that MBIs were considered as feasible, acceptable, and desirable by teachers as well, though the teachers also reported that they rarely found time in the school day for the recommended 20 minutes of teacher meditation. Both Flook et al. (2015) and Li-Grining et al. (2021) showed that participating teachers reported MBIs to be affordable and simple to implement, while other studies (Razza et al., 2020; Viglas & Perlman, 2018; Wood et al.,

2018) pointed out the lack of sustainability for MBIs that demanded outside instructors to implement the program. In this light, MBIs, which train teachers to use mindfulness in the classroom and to teach children mindfulness techniques, have potential for integration of the programs into the daily schedule and culture of the classroom, and therefore to promote generalization beyond the classroom (Wood et al., 2018). As noted in Li-Grining et al. (2021), when trained in MBIs, teachers used the techniques more frequently than expected, and teachers reported using mindfulness to “turn transitions into teachable moments.” Future program development and studies may benefit from focusing on training teachers in mindfulness, integrating mindfulness into the daily schedule and activities of the classroom, and extending training to parents, guardians and caregivers to support generalization outside of the school environment.

Implications for Future Research

Several limitations were found in the studies reviewed. One limitation was related to sample size. Most of the studies included a small sample and the median sample size for the 18 studies reviewed were 86. Only four of the studies included over two hundred participants (Crooks et al., 2020; Jackman et al., 2019; Thierry et al., 2018; Zelazo et al., 2018). Thus, these results suggest a need for more studies with larger sample sizes that include various early childhood settings serving children with diverse backgrounds (e.g., cultural, linguistic, socio-economic backgrounds) as well as children at risk or children with disabilities.

Another limitation includes some issues in measurements. First, of the 13 studies which used teacher rating scales to measure changes in children's self-regulation, only four studies (Flook et al., 2015; Kim et al., 2020; Moreno-Gómez and Cejudo, 2019; Wood et al., 2018) used blind measures, meaning that the purpose of the MBIs and/or teacher measures were not shared with the participating teachers. Thus, other studies might involve the potential for biased reporting from teachers regarding self-regulation changes. Another issue in measures is that only three studies included follow up measures, each noting ongoing growth in self-regulation up to 6 months later (Moreno-Gómez and Cejudo, 2019; Zelazo et al., 2018). Lack of follow up measures may preclude determination of prolonged changes in self-regulation due to the MBIs. Thus, future research needs to consider blind measures and follow-ups when examining the effectiveness of MBIs.

Additionally, the intervention fidelity is an area that needs more attention. Across the 18 studies, 15 different programs were used under the umbrella of MBI. Each MBI's unique characteristics, including intervention components, duration and frequency of the MBI, and teacher training and program fidelity, limit the ability to determine which characteristics

of each program support emotional, behavior, or cognitive self-regulation, and what factors moderate the effects of the interventions. This issue is addressed by several researchers (Crooks et al., 2020; Thierry et al., 2018; Viglas & Perlman, 2018; Zelazo et al., 2018), all of whom recommend closer examination of specific components of MBIs and measures of those components to determine which practices directly support (a) the development of self-regulation, (b) different facets of regulation and (c) the maximum child engagement in mindfulness-based programs. Only six studies reviewed reported measures for intervention fidelity using teacher rating scales (Crooks et al., 2020; Janz et al., 2019; Li-Grining et al., 2021; Thierry et al., 2016, 2018; Wood et al., 2018). Thus, future research needs to examine intervention fidelity that can help researchers more accurately interpret the study outcomes and replicate the MBIs.

As described in the results section, many of the MBIs used in the reviewed studies did not include substantial parental participation. Only five studies (Crooks et al., 2020; Jackman et al., 2019; Razza et al., 2015; Thierry et al., 2016; Wood et al., 2018) included parental measures for their children's change in self-regulation. Only the study by Jackman et al. (2019) included parental training in mindful parenting skills. Lack of significant parental involvement, in the form of training in mindful parenting skills and mindfulness practices, may prevent the usage of mindfulness practices outside of the school environment. Given the significant influence that parenting and other cultural factors play on the development of self-regulation, a lack of family components in the MBIs may impact the ability of children to generalize mindfulness practices across home and school settings. Thus, researchers have recommended the inclusion of parent components, including mindfulness training in future MBI research efforts (Crooks et al., 2020; Flook et al., 2015; Jackman et al., 2019; Janz et al., 2019; Li-Grining et al., 2021; Razza et al., 2020; Zelazo et al., 2018).

Additionally, attention should be drawn to the need for measuring children's perceptions of mindfulness practices, and the effect that self-awareness has on children's self-regulation of emotions, attention, and behaviors. Components of the *OM* program (used in Jackman et al., 2019), the *MindUp* program (Thierry et al., 2016) and the *Settle Your Glitter program* (Thierry et al., 2018), which included direct lessons in neuroscience, emotions, impulse control, and awareness, should be examined to determine the role the programs play in increasing children's self-awareness, and the subsequent impact this has on self-regulation. As revealed in Rashedi and Schonert-Reichl (2019), children who participate in MBIs use more language related to awareness of their self-regulation skills. In this light, including children's perspectives in research has potential to shed light on the value of direct instruction in metacognition and self-regulation, and should be included in future research regarding using MBIs

to build self-awareness, as a potentially essential component of self-regulation.

Additional research into the impact of MBIs on the atmosphere and stress of the classroom is also worthy of consideration. Jennings et al. (2017) found that using mindfulness practices in the classroom reduced teacher stress, and improved the well-being and overall quality of the classroom. Janz et al. (2019) suggested that mindfulness in the classroom reduced the stress levels of teachers and thus lowered the incidence of emotional reactivity of teachers to challenging behaviors of the classroom. Thus, exploring the impact of mindfulness-based programs on teachers' perceptions of challenging behaviors would, therefore, be an important topic of future research. In addition, several studies (Flook et al., 2015; Razza et al., 2015, 2020; Zelazo et al., 2018) that measured changes in participating children's stress and cortisol levels also provided further insight into the benefits of mindfulness on children's stress levels and subsequent abilities to self-regulate. If mindfulness work can lower the stress and emotional reactivity of teachers, similar changes may be found in children who practice mindfulness. In this way, incorporating mindfulness into daily classroom routines in early childhood settings may result in less stressful environments, less emotional reactivity, and thus a healthier emotional climate for the development of self-regulatory skills. Given the current context of the global COVID-19 pandemic and its impact on teachers, families, and school environments, use of mindfulness skills in the classroom seems to be more urgently needed than ever.

Implications for Practice and Policy

Results from the current review showed positive effects of mindfulness-based programs on the development of self-regulation skills in young children. Despite the short duration of some studies and the need for longitudinal studies to track the effects of mindfulness practices across multiple years and settings, the research findings were positive regarding mindfulness-based programs, their feasibility and acceptability in the classroom, and general teacher perceptions of the program values in early childhood settings. Given these trends, administrators, social workers, guidance personnel, teachers, and families may benefit from increasing their knowledge of MBIs, which are designed to bring mindfulness into the classroom setting and the home setting in an age-appropriate manner for young children. Professional development opportunities that focus on teaching mindfulness skills to teachers via programs such as *Cultivating Awareness and Resilience in Education (CARE)*; Jennings et al., 2017) or *Mindfulness Based Stress Reduction (MBSR)*; Kabat-Zinn, 2003), have potential to build a foundation for bringing mindfulness into schools and reducing the

overall stress level of teachers (Razza et al., 2020). Further professional development which introduces teachers to age appropriate mindfulness tools and programs for children, and which reflect research findings regarding maximizing young children's engagement (Poehlmann-Tynan et al., 2016; Rashedi & Schonert-Reichl 2019; Wood et al., 2018) has potential to support the organic integration of mindfulness practices into classroom routines, reduce the need for supplemental instructors or specialists, and promote program sustainability (Flook et al., 2015; Poehlmann-Tynan et al., 2016; Razza et al., 2020).

The current review further highlights the potential role of families in the development of mindfulness skills of young children. As noted above, several researchers iterated the importance of increasing parental involvement in MBIs to increase the potential for reinforcement at home, and generalization of mindfulness skills and self-regulation skills across multiple settings. Generalization of skills across settings suggested by the multi-year work of Thierry et al. (2016) and prolonged use of mindfulness practices throughout development has the potential to support self-regulation skills, reduce stress, and promote overall wellness for children. As parents/guardians are ideally a constant for children throughout their lives, their involvement is essential to ongoing use of practices to support self-regulation. In this light, early childhood settings may benefit from providing opportunities to share mindful parenting skills, and mindfulness practices with parents and guardians, through parent education opportunities, feedback and support conversations with parents, weekly communications with parents, or shared training in the programs (e.g., *CARE* or *MBSR*) as noted above.

As noted across the studies reviewed, MBIs used in early childhood settings had positive effects on all children, but the most significant effects on the children who needed the skills the most (e.g., children with delayed self-regulation, experienced trauma, or executive functioning deficits). Given these findings, the potential for mindfulness to support the development and health of children as a targeted Tier 2 or intensive Tier 3 intervention is worth exploration. For example, the successful use of an MBI in dialectical behavioral therapy for adolescents (Goldstein et al., 2007) and Siegel's *Mindsight* for young children (2007) across the developmental spectrum indicated a potential for targeted and intensive age-appropriate use of mindfulness interventions. Given the significance of self-regulation in relation with the trajectories of social and emotional health, utilizing mindfulness tools intensively with young children who exhibit dysregulation has potential to build protective factors against later developing behavioral and academic difficulties and social and emotional disorders.

Finally, it is important to note the implications of this research for educational policy. As research indicates,

self-regulation skills play a significant role in young children's successful trajectory that includes the development of resilience, social emotional skills, and coping strategies (Janz et al., 2019; McClelland et al., 2013; Moffitt et al., 2011; Montroy et al., 2016). It is thus the responsibility of educational policy makers to refocus measures of early childhood program effectiveness on children's emotional, behavioral, and cognitive self-regulation skills and well-being and to support administrators and teachers to incorporate developmentally appropriate mindfulness-based programs in daily school activities. Despite this need, public funding for early childhood centers in the United States is increasingly tied to academic and cognition-based outcomes (U.S. Department of Health and Human Services, 2021). Policy support for MBI use in the school setting and funding to support research of MBIs for children of all ages, have potential to support the emotional and academic success of all children, including very young children. These supports will help the development of healthy school environments and provide opportunities for children to practice self-regulation skills, which are necessary for life success.

Limitations and Conclusion

The current literature review has several limitations. First, when searching for articles for this review, the broad spectrum of mindfulness-based programs was not anticipated. In this light, results of this review did not provide differentiations among the MBIs (e.g., yoga based, sensory awareness focused, or mindfulness plus SEL). While this review revealed this plethora of programs and the growing momentum of mindfulness programming in early childhood, the variety of the program components brings into the review a wide range of potential moderators, which make determination of effectiveness difficult. Another limitation was that all studies reviewed focused on mindfulness as universal programs in general early childhood classroom settings. As mentioned above, studies which examine MBIs in small group settings with targeted at-risk populations or in intensive therapies with young children may provide additional insight regarding the potential of MBI for supporting self-regulation development. Finally, as this review included studies published in peer-reviewed journals that examined mindfulness and MBIs in early childhood settings, these inclusion criteria limited the extent that other literature such as book chapters, unpublished studies or thesis, and literature review papers could be identified and included.

Despite the limitations, findings from this literature review provide a thought-provoking view of mindfulness practices and MBIs used in early childhood settings. The momentum mindfulness programs are currently experiencing in school settings (Oaklander, 2016) cannot happen without research support. As described above, ongoing research

on mindfulness in schools, and education of practitioners and teacher trainers in the skills of mindfulness hold significant potential to increase the health and wellness in schools, and provide vulnerable children with protective skills to support their success. In an era in which educators, families, and children are facing unprecedented levels of stress and distress caused by a global pandemic, the need for these skills feels more important than ever.

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Thank you.

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