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ORIGINAL PAPER

A Pilot Study of Contemplative Practices with Economically Disadvantaged Preschoolers: Children's Empathic and Self-Regulatory Behaviors

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Abstract This pilot randomized controlled trial with economically disadvantaged preschoolers investigated the feasibility and preliminary effects of a mindfulness intervention. We examined its effect on children's empathy and self-regulation and explored how the curriculum might meet the needs of children attending federally subsidized preschools. Children in five preschool classrooms were randomly assigned by classroom to either a 12-week mindfulness intervention (two classrooms; $n=15$) or a treatment as usual (TAU; three classrooms; $n=14$) and assessed at three time points: pre-intervention (Time 1), immediately post-intervention (Time 2), and 3-month follow-up (Time 3). Children in the mindfulness intervention significantly increased their attentional focus from Time 1 to Time 2 compared to children in the TAU group. Similarly, compared to the TAU group, children in the mindfulness intervention significantly increased their self-regulation skills at Time 2, and these results were maintained at Time 3. There were no changes in empathy or compassion in either the TAU or mindfulness intervention group. Qualitative analysis of classroom observations and instructor interview data suggested that the intervention can be developmentally structured to meet the needs of economically disadvantaged children.

Keywords Mindfulness · Children · Compassion · Empathy · Self-regulation

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Introduction

Programs attempting to facilitate mindfulness in children have proliferated across the USA (Shapiro et al. 2014; Zelazo and Lyons 2011). Secular mindfulness practices for children make use of mental training and self-management techniques (Rempel 2012), with the primary goals of increasing sustained attention and self-regulation (Diamond and Lee 2011; Johnson et al. 2011). Considered a sub-type of social emotional learning (SEL) interventions, contemplative practices with children focus on emotional recognition, emotional regulation, and perspective-taking (Greenberg and Harris 2012; Flook et al. 2010; Shapiro et al. 2014). Children may be asked to recognize and label their emotions or inner experiences without judgment, while attending to their peers' affective and emotional states, possibly instigating empathic responding. Additionally, mindfulness interventions include activities designed to generate compassion for others by identifying common humanity and instilling value in the desire to ease another's suffering once it is recognized. Preliminary evidence suggests that mindfulness curricula may offer an additional approach for improving self-regulation and executive function in young children (e.g., Flook et al. 2015; Razza et al. 2013) as well as reducing anxiety symptoms in school-age children in both low-risk (Napoli et al. 2005) and high-risk contexts (Semple et al. 2010), although its capacity to impact children's empathy or compassion has yet to be evaluated.

Techniques germane to contemplative programs seeking to foster self-regulation, empathy, and compassion include (1) promoting purposeful, sustained attention to the present moment, often in the form of sitting or walking meditations or exercises designed to focus attention on an

external stimulus (e.g., focusing on the sound of a bell ringing); (2) identifying the emotional reactions of characters in stories read in class; and (3) applying the suffering of characters in stories to experiences in real life and identifying ways in which participants can help people in real life. Of course, these techniques are adapted to make them developmentally appropriate for young children and may include briefer exercises designed to focus attention on simple emotions or breathing, referring to pictorial representations of emotions to help begin to identify them and focusing on simplistic scenarios young children may encounter (Shapiro et al. 2014; Flook et al. 2015). Several types of programs offer such experiences, including mindful yoga (e.g., Razza et al. 2013) and school-based mindfulness programs (e.g. Flook et al. 2015). Yet, despite the growing number of secular contemplative curricula designed for young children, particularly those implemented in the classroom, there is a dearth of research investigating their efficacy or effectiveness (Greenberg and Harris 2012), especially for children at heightened risk for maladaptive outcomes. In contrast, there are several other types of social emotional learning programs without an express focus on cultivating present-moment awareness, empathy, or compassion that have been investigated for economically disadvantaged children, with some promise (e.g., Domitrovich et al. 2007).

It has been argued that one can teach children contemplative practices in school settings to improve their self-regulation (Greenberg and Harris 2012; Shapiro et al. 2014). Mendelson et al. (2010) tested a pilot mindfulness program with low-income urban fourth and fifth graders and found that it was feasible and had a positive impact on children's self-reported responses to stress. A randomized control trial with second and third grade children found improvements in executive functioning following completion of a mindfulness intervention (Flook et al. 2010). However, teachers who were aware of the children's assigned condition reported on children's skills (the teachers could not be blinded); thus, no objective assessment data were available. Recently, Flook et al. (2015) implemented a 12-week mindfulness curriculum with 4-year-olds in kindergartens and found positive effects on children's self-regulation and prosocial behavior; yet, the majority of the children in the study had well-educated parents and were white, thereby limiting generalizability. Despite these positive findings, there are no published studies investigating the effects of secular contemplative interventions for economically marginalized preschool children.

Young children who experience poverty are at greater risk than their more affluent peers for exhibiting elevated behavior problems and self-regulation difficulties (Brooks-Gunn and Duncan 1997) especially in school (Raver 2012). Inhibitory control, a major component of self-regulation and executive functioning, is the ability to suppress automatic, proponent responses or thoughts in order to exhibit a secondary (often more acceptable) response (Garon et al. 2008). The development of inhibitory control and other executive functions is rapid during the preschool years (Zelazo et al. 2008), and deficits in the control of automatic thoughts and responses are associated with problems in school readiness and behavior (Hughes and Ensor 2011). Because deficits in executive functions are particularly marked for low-income children (Hackman and Farah 2009; Raver et al. 2013), it is thought that low-income preschool children may benefit most from mental training focused on improving attentional skills (Zelazo and Lyons 2012).

In addition to self-regulation, secular mindfulness is also designed to increase both empathy and compassion in children. The concept of empathy has been defined as an individual's ability to recognize another's emotions and perspective and to produce a response that is affectively and cognitively similar to the observed emotions or perspectives (Batson 2009; Knafo et al. 2008; Roth-Hanania et al. 2011). Compassion is defined in this study as having an affective response to the suffering of others by feeling some measure of those emotions, while also desiring to alleviate their suffering through prosocial responding. Compassion has become increasingly recognized as indicative of psychological resilience and has been suggested to promote positive intergroup relationships across the lifespan (Greenberg and Harris 2012; Neff and McGehee 2010; Welker et al. 2014). Given the strains on low-income children specifically and the prevalence of bullying among youth in general, interventions that develop an inclination for holding compassion for others at a younger age holds research value. To date, however, the concept of compassion has rarely appeared in the child development literature; instead, scholars have studied children's "concern for others" and "empathic responding" or engagement in caring, comforting, or prosocial behaviors (Funk et al. 2008; Van Hulle et al. 2013; Sterling and Friedman 1996; Zhou et al. 2002). For example, although children's willingness to share in hypothetical situations has been empirically investigated as an outcome of a mindfulness intervention (Flook et al. 2015), children's capacity to experience empathy or extend compassion have not yet been assessed as outcomes of interventions involving contemplative practices with children.

Recent reviews of the field have concluded that research quality is too inadequate to reach strong conclusions about the efficacy or effectiveness of interventions involving secular contemplative practices with children, and that studies are needed that are grounded in developmental theory; use developmentally appropriate, valid, and reliable measures; and feature randomized controlled trials (RCTs) and follow-up

assessments (Greenberg and Harris 2012; Shapiro et al. 2014). Additionally, to account for ecological validity, Black and Fernando (2013) called for studies with diverse children in real-world settings. We conducted a mixed method pilot study to assess the feasibility of instituting a mindfulness intervention in preschools with economically disadvantaged children, and we examined preliminary outcomes. We hypothesized that children in the mindfulness intervention would show (1) higher rates of both empathic and compassionate responding and (2) better self-regulation and executive functions than children in the control condition. We also conducted classroom observations and instructor interviews to determine how the mindfulness intervention could meet the needs of economically disadvantaged children.

Method

Participants

Twenty-nine children aged 3 to 5 years (M=47 months, SD= 6.35 months; 51 % boys) from five classrooms across three low-income, federally subsidized full-day preschools in a mid-sized Midwestern city were recruited. Of the 78 children who attended the preschools, 33 were eligible for recruitment because they were already participating in a dialogic reading program designed to support school readiness in children from low-income families (parents had to report their income upon registering at the school to determine eligibility) (see Fig. 1). The dialogic reading program sought to increase school readiness by promoting the discourse (i.e., dialogue) between adult and child during book reading by asking the child questions, correcting and praising the child's inquiries and explanations, and scaffolding the child's interaction with the story content (Arnold and Whitehurst 1994; Whitehurst et al. 1994).

Of the 33 children eligible to participate in the study, 29 parents signed consent forms. Seventy-two percent (n =21) of the study children were non-White and 100 % were living in poverty, according to federal guidelines. Seventeen percent of children attrited throughout the course of the study. These children had left their preschools by time 3 because of family moves or other reasons. Chi-square tests revealed no significant differences on demographics between children who attrited and those who completed assessments at all three time points (T1=pre-intervention; T2=post-intervention; T3= 3 month follow-up). Comparison of participants completing T1 and T2 assessments with those completing only T1 assessments revealed significant differences on integrated self-regulation and representations of empathic responding. In addition, children who did not complete T3 assessments (n=5) showed fewer representations of empathic and compassionate responding than those who completed all assessments (n=24).

Procedure

Recruitment materials were sent home with each child already enrolled in the dialogic reading program at each of the preschool sites. Parents signed consent forms, and children verbally assented at the time of data collection. Children were debriefed using a script following the Distress Task. No compensation was provided. All procedures followed a standard IRB-approved protocol. As part of the dialogic reading program from which children were recruited, every child was paired with a college student mentor to receive 4 h per week of classroom support for 9 months during the academic year.

Two of the five participating classrooms were randomly selected to receive the 12-week mindfulness intervention. All children enrolled in this study from these two classrooms (n=15) received the mindfulness intervention in addition to the ongoing dialogic reading program, whereas the children enrolled in the study from the remaining three classrooms (n= 14) served as the treatment-as-usual (TAU) group. The TAU group children received only the ongoing dialogic reading activities.

The same assessments were administered to children and coded by trained researchers blind to condition at three time points: immediately prior to the mindfulness intervention (T1), immediately following the mindfulness intervention (T2), and again 3 months later (T3). Children were assessed in a quiet room at each preschool location. Twenty-five percent of the protocols were assessed for interrater reliability. Instructors of the mindfulness intervention and their supervisor also participated in open-ended interviews at the end of the program about their perceptions of children's engagement in activities and ideas about implementation with young children in low-income preschools. Semi-structured interviews were conducted by the PI (Poehlmann-Tynan), who recorded detailed notes and verbatim quotes.

TAU Group: Dialogic Reading Only Children in the TAU group participated in the 9-month dialogic reading program. The program consisted of receiving one-on-one attention from college student mentors to foster school readiness and early literacy skills (especially dialogic reading) in structured sessions held twice per week. The 2-h sessions occurred in the following sequence: circle/group time (30 min) during which mentors remained focused on their partner children while participating in literacy activities as a group; one-on-one dialogic reading time wherein the mentor and child interacted apart from the group; and child choice time, when the mentor and child played together with materials of the child's choice. Group activities consisted of group story time and crafts. Group activities were led by a senior college student who was not paired with a child, but rather managed the other mentors.

The dialogic reading program was designed to increase school readiness in the areas of literacy and social

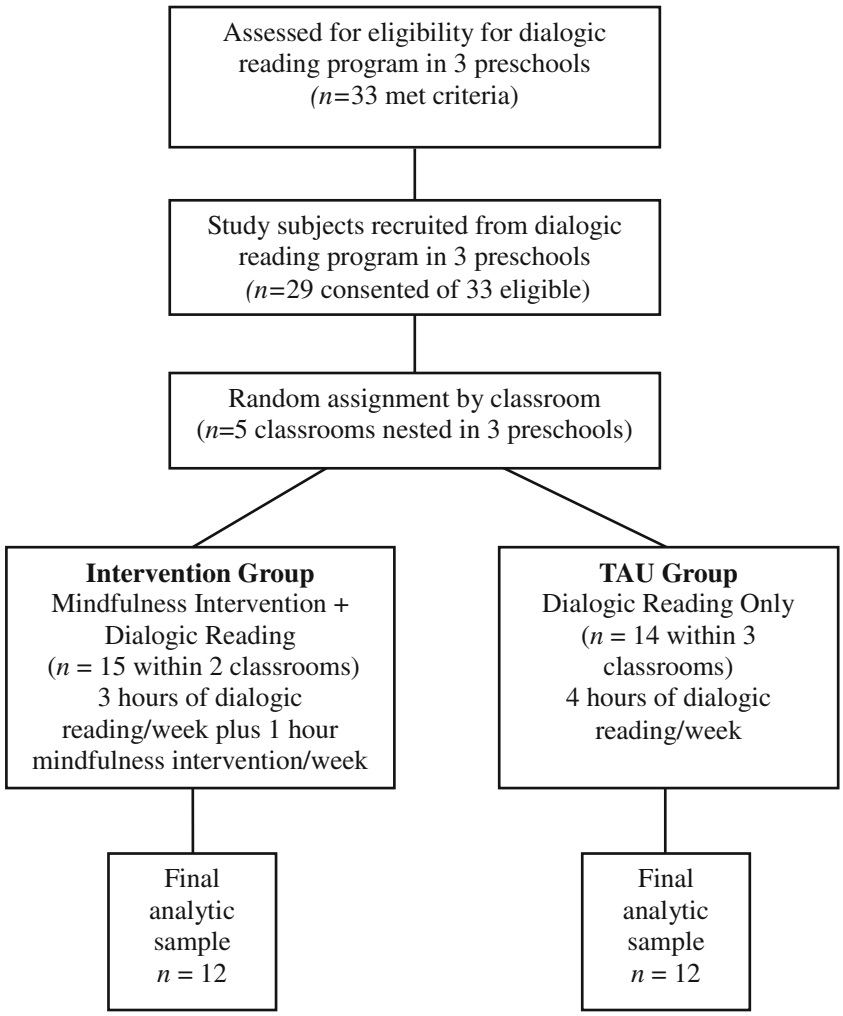

Fig. 1 Diagram of study stratification

competence. In addition to dialogic reading, it provided a context that gave children opportunities to develop skills and strategies to have positive interactions with peers and college student mentors. Each mentor scaffolded the child's engagement in the program's activities as the child learned to problem solve with peers in literacy-based activities.

Mindfulness Intervention Group Children randomized into the mindfulness intervention group received an adapted mindfulness curriculum for 12 weeks (the Kindness Curriculum 2013; Flook et al. 2015) in addition to participating in the 9-month dialogic reading (DR) program. The Kindness Curriculum was delivered by trained instructors in 20–30-min lessons twice per week for 12 weeks during the fall semester of the 9-month academic year. For this study, the original Kindness Curriculum (KC), developed by the Center for Investigating Healthy Minds as a school-based intervention to facilitate mindfulness and prosocial behavior in 4-year-old kindergarteners, was adapted. The original KC was implemented across 8 weeks, with three lessons per week. The adapted version was 12 weeks, with two lessons per week, lasting 20–30 min per lesson (see Table 1). The original KC required classroom teachers to participate in a modified Mindfulness-Based Stress Reduction (MBSR) program prior to the intervention in order to promote reinforcement of learning goals during classroom time. The adapted version offered MBSR to the college student mentors. Four of the 15 college students completed the MBSR course. Other elements of the KC were the same as the original: (1) use of experienced meditation instructors with extensive mindfulness practices (daily practice over the course of 5–10 years) with backgrounds in early childhood education to administer the curriculum to the children and (2) use of mindfulness-themed books, posters, and art projects during intervention sessions and in classrooms throughout the year to facilitate generalization of mindfulness. In the present study, the intervention materials were restricted to classrooms to which children in the control group did not have access. Additionally, the creator of the KC observed each instructor weekly and provided them with feedback on the delivery of the KC in order to ensure fidelity to the program.

Table 1 Themes and learning objectives of the Kindness Curriculum (mindfulness intervention)

Theme	Learning objectives and activities
Mindful bodies and planting seeds	Pay attention on outside and inside (breath and stillness) by focusing on the sound of a fading bell and taking three deep breaths once sound has ended
	Focus on breath using belly breathing; rocking a stuffed animal to sleep on the belly using deep breaths
	Demonstrate acts of kindness with peer
I feel emotions on the inside	Begin reciting "Growing Friendship Wish" (May all I think, say and do not hurt anyone and help everyone)
	Reflect on, identify, and share emotions
	Use emotion vocabulary and language to work out problems
How I feel shows on the outside	Explore and share physical sensations of emotions in body via mimicking animal movements
	Begin to identify others' emotions by paying attention to physical expressions in others
	Demonstrate ways to be kind to own and others' feelings
Taking care of strong emotions on the inside and outside	Make and appropriately use a "mind jar" (watch emotions settling)
	Tell three ways to care for difficult emotions
Calming and working out problems	Lead "animal movements" practice
	Repair accidents by saying: "I'm sorry, I didn't mean it" or "I see it was an accident" (forgiveness)
Gratitude	Express gratitude for: things they have, their body, people
	Experience and share about mindful eating
All people depend on each other and the earth	Name three ways they are similar and different from children around the world
	Offer caring wishes to people around world
Gratitude and caring for our world	Name three gifts from the earth
	Experience a pretend jungle walk and offer caring wishes for the earth and creatures

At each session, a children's book was read aloud and used to reflect upon that session's theme. Each theme lasted for three sessions. The mindfulness intervention was an adapted version of the Kindness Curriculum presented in Flook et al. (2015)

The KC is composed of eight themes and includes breathing and movement exercises, music, reading children's literature about kindness and caring, and activities that provide opportunities to increase awareness of inner and outer experiences of emotions, sharing, and kind acts (Flook et al. 2015; Kindness Curriculum 2013; see Table 1). A typical lesson began with the instructor reviewing a pictorial chart of the session's agenda while the children were seated in a semicircle with their college student mentors. Every session began with "inviting the bell," wherein a designated child rang a small bell while the rest were asked to quietly listen until the sound faded, with children raising their hands when they could no longer hear it. The instructor then invited the group to take three deep breaths, after which another designated child (this changed each session so that each child took this role at least once) led the group in simultaneously signing and verbally reciting a wish for everyone's happiness. After this, the instructor reminded the children about last week's theme and tied it to the current session's theme, which was explored through a story that was read out loud to the group. After story time, there was movement-based activity, such as animal yoga, in which children imitate certain animals with their bodies, and mindful eating. Other activities included creating and shaking snow globes that symbolized what it felt like on the inside when they became upset. Finally, the children returned to the semicircle for a cool-down restful breathing activity while a song was played. A sample cool-down activity was belly breathing, wherein the children selected a small stuffed animal, laid on their backs, and rocked the animal to sleep on their bellies by taking deep breaths, paying attention to how it felt "on the inside." The session closed with a final ring of the bell. Throughout the KC sessions, the college student mentors attempted to keep the children on task and encourage their participation.

Measures

Observer-Rated Empathy and Compassion Children's empathic responses to a distressed experimenter were assessed using a Distress Task (Zahn-Waxler et al. 1992a, b). Children were presented with an opportunity to comfort a researcher who "accidentally" hurt her finger, expressing pain with

moderate vocalizations and facial expressions for 10 s and then lessening for 10–15 s, while avoiding eye contact for the entire duration of the deception. The task was videotaped and coded on a 1–4 scale, with four representing more frequent and intense empathic (e.g., looking concerned, affective mirroring of distress) and compassionate behaviors (e.g., gentle touching) and verbalizations (e.g., "Did that hurt?" "Are you OK?" in a concerned tone of voice). Interrater reliability was calculated using intraclass correlations (ICC=0.72–0.99).

The Attachment Story Completion Task (ASCT; Bretherton et al. 1990) was administered to assess children's representations of empathic and compassionate responding within the family context. It has been used with young children in high- and low-risk contexts and is correlated with young children's behavior problems and effortful control (e.g., Poehlmann et al. 2014). Using props and small dolls (representing two parents and two children), a researcher asked children to verbalize and act out solutions following the presentation of three story stems that are acted out by researchers: (1) Spilled Juice, when a child spills juice at dinner (i.e., "Mary reaches and spills her juice. Oh, the juice is spilled. Show me what happens now") (2) Hurt Knee, when a child falls off a rock and hurts his knee (i.e., "Jimmy climbs a high, high rock and falls down. He says, 'Boo hoo I've hurt my knee!' Show me what happens next"); and (3) Monster, when a child calls for help, thinking she has seen a monster (i.e., "Mary says good-night and goes up to her bedroom and says 'There's a monster in the bedroom!' Show me what happens now"). Children's reactions to each story stem were video recorded and later coded in our lab. Children's resolutions to story stems were coded in a binary fashion for two variables: empathy and compassion (0=not present for empathy and compassion, 1=present for empathy and compassion). An example of empathy in the doll story context included acting out or verbalizing recognition of the child doll's emotions (e.g., "He's crying, he's sad.") and an example of compassion included expressing a desire to help the child or actually helping the child doll (e.g., "Oh no! His mommy gets him a bandaid to help him, to help his knee feel better. She kisses him"). Scores for each code were summed across stems, ranging from 0 (present in no stems) to 3 (present in all stems) for each code. Interrater reliability ranged between κ=0.75 and 0.95; M=0.91.

Assessments of Self-Regulation and Executive Functioning The Head-Toes-Knees-Shoulders Task (HTKS; Ponitz et al. 2009; McClelland et al. 2007) directly measured preschool children's integrated self-regulation skills. The HTKS involved a short game with paired rules, e.g., "touch your head," "touch your toes." Children first responded naturally and then were instructed to respond in the opposite way (touching head when told to touch toes). Ratings were completed in vivo, although children's performance was also videotaped and in vivo scores were checked for reliability in our lab at a later point. Discrepancies were resolved by conference. Total correct responses (range of 0–60) were used (α=0.80–0.83 across time points). The HTKS has good psychometric properties and predicts academic achievement (McClelland et al. 2007).

The Go/No-Go Task is a well-established measure of attentional focus, impulsivity, and inhibitory control for preschool children (Yong-Liang et al. 2000). Pictures were presented for a maximum of 1500 ms, with a fixed inter-stimulus interval of 1500 ms. Inhibition is required in 50 % of trials, presented in random order over 48 performance trials (following practice) (Raaijmakers et al. 2008). A "hit" is a correct response for the go stimulus and a "correct rejection" is a correct response to the "no-go" stimulus. Both of these are frequency counts. Reaction time was also examined for the "go" and "no-go" stimuli.

Observation and Interview Data Fourteen of the 24 mindfulness intervention sessions were observed in person by a graduate student researcher or the PI. The occasional presence of non-study children in the classrooms prevented video recording sessions, as did the inability to set a camera on a tripod because children often moved quickly about the classroom. The researchers and the author of the mindfulness intervention alternated observation days in each classroom, resulting in the consistent presence of a quiet adult stationed in the back of the classroom at every mindfulness intervention session. Each observer arrived 15 min before the beginning of the mindfulness intervention session in order to acclimate the children to their presence. Detailed field notes regarding children's activity level, engagement, and emotional lability were recorded by the researchers observing in addition to note recording the types of activities and tasks in which the children participated.

Following the conclusion of the mindfulness intervention, the PI conducted interviews with the two mindfulness instructors and their supervisor. Detailed notes were recorded from the interviews about their experiences of the intervention and their thoughts about children's engagement during various activities. Notes from interviews and observations were subjected to qualitative analysis, described as follows.

Data Analyses

Eight repeated-measures analyses of covariance (RANCOVAs) were conducted to examine changes in variables over time as a function of the intervention, controlling for age: empathy on the distress task, empathy and compassion scales of the ASCT, HTKS total score, number of hits on the Go/No-Go Task, number of correct rejections on the Go/No-Go Task, reaction time for the Go trials, and reaction time for the No-Go trials. The within-subject variable (time) had three levels (i.e., T1 pre-intervention assessment, T2 post-

intervention assessment, and T3 3-month follow-up assessment). Because this was a pilot study, the significance level for main effects was set to $p<0.10$. The partial eta-squared statistic was used to assess effect size, with $\eta^2=0.02$ indicating a small effect, $\eta^2=0.09$ indicating a moderate effect, and $\eta^2=0.25$ indicating a large effect (Cohen 1988).

Results

Group Equivalence and Attendance

Following randomization, T1 differences between intervention and control groups were found on age, with the control group slightly older (44.71 and 49.26 months, $t(27)=-2.09$, $p=0.052$). Thus, age was controlled in all analyses.

Although the average child in the mindfulness intervention attended 21 of 24 sessions of mindfulness (SD=5.9), the majority of children attended every session (mode=24). According to preschool staff, reasons for non-attendance ranged from child illness to family instability. Attendance trends also varied by location. For example, at one of the preschools receiving the mindfulness intervention, 75 % ($n=6$) of the children attended all of the sessions, whereas at the other location, only 40 % ($n=2$) of the children attended all of the sessions.

Effects of Mindfulness Intervention

RANCOVA results are presented in Table 2. For empathic responding observed during the Distress Task, the RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) showed no effect of time, $F(2,38)=0.04$, p=ns. There was no significant interaction between group and time, $F(4, 38)=0.44$, p=ns, demonstrating no effect of the dialogic reading program or the mindfulness intervention on children's empathy in the Distress Task across time points.

For representations of empathy in the ASCT, the RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) showed no effect of time, $F(2,38)=0.21$, p=ns. There was no significant interaction between group and time, $F(4, 38)=0.39$, p=ns, demonstrating no effect of the dialogic reading program or the mindfulness intervention on children's representations of empathy across time points.

For representations of compassionate responding in the ASCT, the RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) showed no effect of time, $F(2,38)=0.11$, p=ns. There was no significant interaction between group and time, $F(4, 38)=1.27$, p=ns, demonstrating no effect of the dialogic reading program or the mindfulness intervention on children's representations of compassionate responding across time points.

For self-regulation HTKS scores, the RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) revealed a main effect of time, $F(2,38)=3.85$, $p=0.03$, partial $\eta^2=0.168$. There was a significant interaction between group and time, $F(4, 19)=3.28$, $p<0.021$, partial $\eta^2=0.26$, demonstrating increases in integrated self-regulation skills in children receiving the mindfulness intervention (see Fig. 2). To explore this interaction, pairwise comparisons were employed using a Bonferroni-adjusted alpha levels of 0.02 per comparison (0.05/3). The pairwise comparison of group differences from T1 to T2 was not significant, $F(2,19)=1.41$, p= ns. Likewise, group differences from T2 to T3 were not significant, $F(2, 19)=1.91$, p=ns. However, the mindfulness intervention had significantly higher HTKS scores than controls at T3 compared to T1, $F(2,19)=6.22$, $p=0.008$, partial $\eta^2=0.04$.

The RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) revealed a main effect of time on children's "hits" on the Go-No/Go Task $F(2, 38)=3.36$, $p=0.05$, $\eta^2=0.15$. There was a significant interaction between group and time, $F(4, 38)=2.12$, $p=0.098$, $\eta^2=0.18$, with a moderately large effect (see Table 2, Fig. 3). Pairwise comparisons with Bonferroni-adjusted alpha levels of 0.02 per comparison (0.05/3) were used to explore this interaction. Comparisons revealed significant intervention group differences between T1 and T2, $F(2, 19)=4.70$, $p=0.02$, partial $\eta^2=0.33$, with large effects. This suggests children in the mindfulness intervention, compared with children in the TAU condition, significantly improved their self-regulation skills at a greater rate from T1 to T2. Although children in the mindfulness intervention appeared to maintain their gains at T3 (Fig. 3), comparisons were not statistically significant. Pairwise comparisons revealed no significant differences from T2 to T3, $F(2, 19)=1.06$, p=ns, or T1 to T3, $F(2,19)=1.09$, p=ns.

The RANCOVA (between-subjects factor: group (dialogic, mindfulness); covariate: age) revealed a main effect of time on children's number of correct rejections on the Go-No/Go Task, $F(2,38=3.15$, $p=0.05$, partial $\eta^2=0.14$. However, there was no significant interaction between group and time indicating the mindfulness group did not outperform the control group, $F(4, 19)=1.46$ $p=ns$ (Table 2), although the finding suggested a moderate effect size, partial $\eta^2=0.13$ (Table 3).

RANCOVAs (between-subjects factor: group (dialogic, mindfulness); covariate: age) on the reaction time variables for the Go condition were not statistically significant for main effects ($p>0.10$). Similarly, No-Go conditions were not statistically significant for main effects ($p>0.10$). No interaction effects were found ($p>0.10$).

Qualitative Analysis of Observations and Interviews

Using a grounded theory approach (Strauss and Corbin 1998), analysis of notes from the mindfulness instructor interviews and classroom observations included three phases: (a) open coding, when conceptual labels were given to initial groups of

Table 2 Effects of the Kindness Curriculum on children's development outcomes compared to the TAU group (adjusted means)

Measure (response range)	Adj. *M* (SD) for MI+DR group	Adj. *M* (SD) for DR only (TAU) group	*F*	*p* value	Partial η^2
Self-regulation					
HTKS (0–60)					
Baseline	9.91 (5.19)	8.22 (4.14)	3.28	0.021	0.26
Post-intervention	19.88 (7.20)	18.57 (5.74)			
Follow-up	22.11 (5.57)	17.30 (4.44)			
Inhibitory control					
Go/No-Go hits (0–24)					
Baseline	10.29 (3.07)	11.89 (2.45)	2.12	0.098	0.18
Post-intervention	17.90 (1.82)	16.04 (1.45)			
Follow-up	17.82 (2.73)	15.22 (2.18)			
Inhibitory control					
Go/No-Go CR (0–24)					
Baseline	23.42 (2.30)	19.28 (1.83)	1.46	0.258	0.13
Post-intervention	23.36 (2.10)	21.41 (1.68)			
Follow-up	23.18 (0.65)	22.20 (0.52)			
Empathic responding					
Simulated distress (1–4)					
Baseline	2.21 (0.86)	2.59 (0.86)	0.44	0.776	0.05
Post-intervention	2.75 (0.92)	2.72 (0.52)			
Follow-up	2.46 (0.58)	3.00 (0.81)			
Representations of empathy ASCT (0–3)					
Baseline	0.15 (0.32)	0.52 (0.25)	0.39	0.818	0.04
Post-intervention	0.56 (0.45)	0.71 (0.36)			
Follow-up	1.28 (0.42)	1.09 (0.34)			
Representations of compassion ASCT (0–3)					
Baseline	1.84 (0.39)	0.91 (0.31)	0.64	0.54	0.03
Post-intervention	1.44 (0.47)	1.68 (0.38)			
Follow-up	0.80 (0.39)	0.34 (0.31)			

Post-intervention sample sizes: for mindfulness intervention (MI+DR), $n=13$; for the TAU group (DR only) $n=12$. Follow-up sample sizes: for MI+DR, $n=12$; for DR only, $n=12$. Age was controlled in all analyses

MI mindfulness intervention (Kindness Curriculum), *DR* dialogic reading, *HTKS* head toes knees shoulders, *ASCT* Attachment Stem Completion Task, *CR* Correct Rejection Task on Go/No-Go

similar responses; (b) axial coding, when existing links between categories of responses were examined; and (c) selective coding, when categories were refined and grouped around common themes. The PI coded the interview data and field notes. In the open-coding phase, similar responses were grouped into codes. During axial coding, each initial code and its associated narratives were compared with other codes for similarities and differences; some initial codes were combined and others were deleted or recoded. During selective coding, which involved reviewing the interview notes again, codes were grouped into higher-level clusters until abstract thematic categories emerged. Themes were discussed with the research team and refined.

Following coding, four general categories emerged from interviews with the mindfulness instructor and classroom observations: (1) the importance of movement-based activities for children's engagement and attention, (2) variations in implementation affected children's engagement, (3) timing of the program affected children's focused attention, and (4) modifications to the curriculum could make it developmentally appropriate for children with limited school readiness skills.

Classroom Observations Classroom observations indicated that movement-based mindfulness intervention activities engaged children toward the learning goals of "paying attention on the outside and the inside" and developing care for others. Movement-based activities such as active belly breathing with a prop, acting out care for a stuffed animal, attending to the ringing bell with hand movements, singing with gestures and body movements, and animal yoga appeared to elicit the greatest focused attention and engagement from children. Requests that required verbalization without movement or discussion of abstract concepts (e.g., naming ways they were similar or different from children around the world, verbally

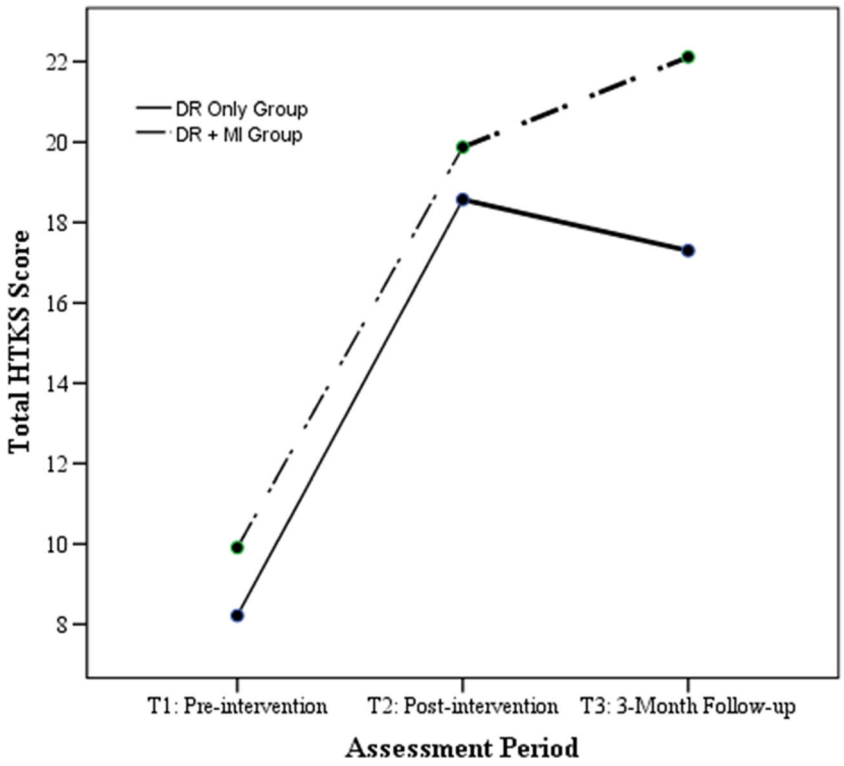

Fig. 2 Change in HTKS total score by treatment group. Age of child controlled in analyses. *DR* dialogic reading only (TAU), *MI* mindfulness intervention

reflecting on a story, imagining something without movement) appeared to invite the least engagement from children. Additionally, there appeared to be variations in the children's engagement for even the most successful activities depending on how the activities were implemented. For example, belly breathing with a prop such as a rock or stuffed animal was more successful in maintaining quiet focus than was concentrating on the breath without such props. Similarly, listening to the bell was an engaging routine activity; although children remained consistently quiet when asked to

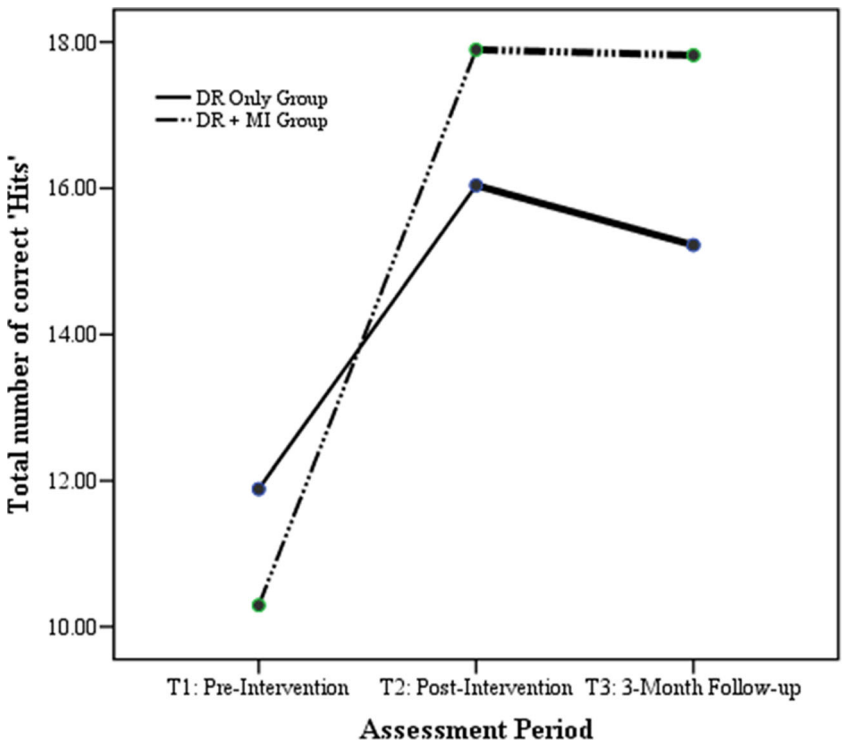

Fig. 3 Change in number of correct "hits" by treatment group. Age of child controlled in analyses. *DR* dialogic reading only (TAU), *MI* mindfulness intervention

Table 3 Effects of the Kindness Curriculum on children's developmental outcomes compared to children in the TAU group (unadjusted means)

Measure (response range)	Unadjusted *M* (SD) for MI+DR group	Unadjusted *M* (SD) for DR only (TAU) group
Self-regulation		
HTKS (0–60)		
Baseline	9.33 (12.71)	8.73 (11.85)
Post-intervention	16.00 (18.42)	20.82 (17.09)
Follow-up	13.92 (16.70)	22.27 (18.45)
Inhibitory control		
Go/No-Go hits (0–24)		
Baseline	11.17 (7.81)	12.09 (6.66)
Post-intervention	14.42 (6.30)	17.09 (4.39)
Follow-up	16.83 (5.01)	16.18 (8.27)
Inhibitory control		
Go/No-Go CR (0–24)		
Baseline	20.25 (5.66)	19.73 (6.39)
Post-intervention	21.25 (6.63)	21.64 (4.78)
Follow-up	23.17 (1.03)	22.45 (2.07)
Empathic responding		
Simulated distress (1–4)		
Baseline	2.21 (0.99)	2.59 (0.86)
Post-intervention	2.75 (0.92)	2.72 (0.52)
Follow-up	2.46 (0.58)	3.00 (0.81)
Representations of empathy ASCT (0–3)		
Baseline	0.25 (0.45)	0.64 (1.03)
Post-intervention	0.75 (1.22)	0.91 (1.04)
Follow-up	1.25 (0.97)	1.36 (1.29)
Representations of compassion ASCT (0–3)		
Baseline	1.33 (0.98)	1.09 (1.14)
Post-intervention	1.67 (1.07)	1.82 (1.25)
Follow-up	0.75 (1.06)	0.45 (0.82)

Post-intervention sample sizes: for mindfulness intervention (MI+DR), $n=13$; for the TAU group (DR only) $n=12$. Follow-up sample sizes: for MI+DR, $n=12$; for DR only, $n=12$. Age was controlled in all analyses

MI mindfulness intervention (Kindness Curriculum), *DR* dialogic reading, *HTKS* head toes knees shoulders, *ASCT* Attachment Stem Completion Task, *CR* Correct Rejection Task on Go/No-Go

take three deep breaths following the silence, they regularly terminated the activity and began moving about the classroom when they were asked to take five, rather than three, deep breaths.

Instructor Interviews Analysis of instructor interview data was mostly consistent with classroom observations, especially regarding the importance of movement-based activities. The instructors noted that when the children were verbally brainstorming thoughts and feelings in a group, they had a tendency to become louder and more active and they were more likely to wander around the classroom. In contrast, instructors noted that movement-based activities may have better captured children's focused attention, especially activities such as belly breathing with a prop and animal yoga.

Two new categories also emerged from analysis of the interviews. Instructors indicated that special attention should be paid to the timing of the curriculum during the school day in relation to other activities. For example, the instructors suggested that, given the contemplative and quiet nature of the mindfulness intervention, children might be more capable of sustained attention if the intervention was delivered following the physically active portion of the preschool day (e.g., outside time). In the current study, the intervention preceded outside play time rather than following it, and it is possible that some children were not calm enough to sustain quiet involvement given their excitement associated with impending playground time. The second new category involved instructors' reflections on ways to modify the mindfulness curriculum to be more developmentally appropriate for children who exhibited limited school readiness skills. Instructors felt that more children in the low-income preschools exhibited more behavioral and academic challenges than other pre-kindergarteners who had previously participated in the Kindness Curriculum and that some children may have needed more adult support to benefit fully from the mindfulness activities. This study was a small pilot study; thus, these issues may be specific to the classrooms and children in this study and may not generalize to other children.

Discussion

Although mindfulness interventions have been applied to populations of high-risk school-age youth (Mendelson et al. 2010) and low-risk 4-year-olds in kindergarten (e.g., Flook et al. 2015), this is the first study to investigate secular contemplative practices in economically disadvantaged preschool children. The results of this mixed method pilot study, although preliminary, suggest that a mindfulness intervention delivered by trained instructors and supported by college student mentors may increase self-regulation and attentional control in economically disadvantaged preschoolers.

Our findings indicate that implementing a mindfulness intervention is feasible and effective with economically disadvantaged preschoolers. Further, qualitative findings provide valuable information about potential considerations when conducting a mindfulness program with this population. For example, instructors noted that such a program may work best after children have had an opportunity to be physically active and that movement- and prop-based activities were most successful in maintaining the children's interest and attention. Finally, adequate adult support may need to be provided to help children remain engaged in the activities. The sample in

this pilot study was small and thus may not generalize to other economically disadvantaged children; nevertheless, instructor reflections on feasibility may prove useful to researchers and practitioners interested in implementing this program in the future.

Children's attentional focus increased more in the mindfulness intervention than in the TAU group, with a medium effect size. Moreover, children in the mindfulness intervention maintained their gains at follow-up, potentially indicating that those children continued to exhibit some of the skills they learned as part of participating in the intervention. Children's integrated self-regulation increased in the mindfulness intervention in comparison to the TAU group at follow-up, with a large effect size. These findings are consistent with prior research on the effects of mindfulness interventions on children's self-regulation and attention (e.g., Flook et al. 2015; Razza et al. 2013) as well as other intervention activities designed to improve self-regulation in young children (e.g., Diamond 2012). The preschool years are a time of normative, developmental increases in attentional focus; thus, increases in these skills for both groups were expected (Zelazo et al. 2008). However, the significantly greater increase for the mindfulness intervention group is evidence of an effect of the intervention. Strengths of our study included use of standardized measures of self-regulation and executive functions in children collected by research assistants blind to condition, rather than relying on perceptions of parents and teachers who were aware of children's treatment condition. Our study also involved a 3-month follow-up assessment. Further, it is important to note that the mindfulness intervention was implemented by instructors who had extensive experience with meditation and mindfulness, a likely critical factor in any successful mindfulness intervention.

Improvements in attentional focus and self-regulation are especially critical for low-income preschoolers, who on average exhibit lower inhibitory control, less optimal executive functions, and more behavior problems than children from middle-class families (Hackman and Farah 2009; Moilanen et al. 2010). Existing interventions targeting improved school readiness for low-income children have suggested that improvements in self-regulation may also be a potential mechanism through which children more successfully transition to school (Raver et al. 2011). Children with better developed self-regulatory skills may be able to pay attention to teachers and to inhibit disruptive or impulsive behavior and thus more successfully focus on learning academic skills (McClelland et al. 2007; Raver et al. 2011). Some scholars have investigated interventions to develop children's social emotional competence as an avenue for school readiness in low-income populations. Although Domitrovich et al. (2007) found moderate effect sizes on children's social competence (as rated by adults) in a randomized control trial of the preschool PATHS curriculum, conclusions comparing the effectiveness of a social emotional learning intervention to a mindfulness intervention for enhancing school readiness should be tentative until research with comparable designs, outcome measures, and sample sizes is conducted. The present study provides some indication that a mindfulness intervention may be effective in improving self-regulation before school age in economically disadvantaged children. Future longitudinal work may be helpful in examining whether the mindfulness interventions may assist in school readiness and future academic performance for economically disadvantaged young children.

This is one of the first studies to attempt to measure changes in empathic and compassionate responding in children as a result of mindfulness interventions. Yet, contrary to hypotheses, there were no changes in children's empathic or compassionate responding following the intervention. Empathic responding involves complex prosocial behaviors, including having an affective response to understand someone else's emotional state (Eisenberg et al. 2006). Although empathy has been studied extensively in young children, compassion has not and may present some measurement challenges as it further includes a desire to alleviate another's suffering once suffering is recognized. To date, generalized prosocial behaviors and empathic responses have been assessed and found to increase from preschool through school age, although prosocial responding appears to be relatively stable within individuals, due to genetic, neuropsychological, and/or environmental reasons (Côté et al. 2002; Eisenberg et al. 2006). It is possible that 1 h of intervention per week is not sufficient to produce changes in empathy without ongoing adult modeling and reinforcement in school and at home. Similarly, it is possible that building the tendency to compassionately respond to another's suffering also requires a more intensive dosage of the intervention than was provided by this study. Additionally, those in the dialogic reading TAU group received some guidance from their college student mentors about emotional identification, perspective taking, and social problem solving. Although not identical to the empathic and compassionate responding activities in the Kindness Curriculum, it may have had a similar effect on children. Lastly, it has been noted that engagement with the intervention is a necessary component of a contemplative practice; future research should collect more systematic data on children's observed or self-reported level of interest in the content and activities (Shapiro et al. 2014).

According to the qualitative analysis of interviews and classroom observations, children were most actively engaged in the movement activities, rather than activities focused on abstract concepts or verbal activities without physical activity. Preschoolers seemed to particularly enjoy the belly breathing with props and yoga movement activities, which teach attentional and self-control skills, and this may be a mechanism through which we saw the preliminary improvements in attentional focus and self-regulation. Although many activities in the mindfulness intervention involved both attentional and

empathic components, the less engaging abstract discussions were more likely to focus on empathy-based material. Thus, future iterations of the program may need to examine how to make empathy-related activities more movement-based and thus more engaging for preschoolers who show a range of school readiness skills. Flexibility in implementation, with changes allowed depending on the developmental needs of the children (e.g., taking three deep breaths rather than five deep breaths) may be important as well. Future work should also more specifically examine the mechanisms of change.

There are several limitations to the current pilot study. First, as a pilot study, the sample size is small; thus, our analyses did not have sufficient power to detect potentially complex or subtle findings. For example, our sample size limited our analyses to the level of individual child rather than our unit of randomization: the classroom. Additionally, block randomization by classroom resulted in the non-independence of subjects, an assumption of the statistical analyses conducted in this study. It is possible that this could bias the tests used to identify intervention effects. Second, our recruitment strategy may result in less generalizability, as the low-income children were already enrolled in an ongoing dialogic reading program. Moreover, it remains unclear if the contemplative exercises in the mindfulness intervention are the most appropriate for economically disadvantaged preschool children or if other specific mindfulness exercises might be more beneficial. The structure of the mindfulness intervention may require further adaptation to fully meet economically disadvantaged children's needs, including the need for movement to help sustain focused attention and careful implementation of activities. Further, each classroom had a different mindfulness intervention instructor. Although a strength of this design is that both instructors had a background in early childhood education and were both seasoned practitioners and trainers in mindfulness and meditation, and they were monitored for quality control by the creator of the Kindness Curriculum, it is possible that the unique features of each instructor and each cohort created different treatment experiences. Future research with sample sizes large enough to explore nested effects is needed. Another instructor-related weakness pertains to the possibility that the Kindness Curriculum instructors were more experienced than those in the comparison group, creating a potential confound. Lastly, although the training in MBSR was offered to all of the college student mentors paired with the children receiving the mindfulness intervention (n=15), only a fraction completed the training (n=4). As a result, only a small number of the children receiving the intervention may have received reinforced guidance from their mentors during the course of the intervention.

Interest in school-based mindfulness interventions has been growing substantially in recent years, and many schools are teaching mindfulness skills without systematically or rigorously assessing their efficacy (Shapiro et al. 2014). Our pilot study shows preliminary evidence that children improve in their attentional focus and self-regulatory skills following a 12-week mindfulness intervention. However, much more work is needed in this area. There needs to be larger-scale, longitudinal studies to examine the long-term effects of mindfulness on self-regulation and systematic evaluation of the usefulness and engagement of various mindfulness-based activities, along with investigation of the potential mechanisms of change.

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