

Evaluating the Implementation of the *Pyramid Model for Promoting Social-Emotional Competence* in Early Childhood Classrooms

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Abstract

We conducted a potential efficacy trial examining the effects of classroom-wide implementation of the *Pyramid Model for Promoting Young Children's Social-Emotional Competence* on teachers' implementation of *Pyramid Model* practices and children's social-emotional skills and challenging behavior. Participants were 40 preschool teachers and 494 children. Using a randomized controlled design, 20 teachers received a professional development (PD) intervention to support their implementation of the practices. The 20 teachers in the control condition received workshops after all study-related data were collected. Teachers who received PD significantly improved their implementation of *Pyramid Model* practices relative to control teachers. Children in intervention teachers' classrooms were rated as having better social skills and fewer challenging behaviors relative to children in control teachers' classrooms. Exploratory analyses showed that children at elevated risk for behavior disorders in intervention teachers' classrooms had improvements in their observed social interaction skills relative to similar children in control teachers' classrooms.

Keywords

challenging behavior, social emotional, professional development, coaching, positive behavior support

Estimates of the prevalence of challenging behavior in young children indicate that social and emotional challenges occur in approximately 10% to 20% of children between the ages of 2 and 5 (Brauner & Stephens, 2006; Egger & Angold, 2006; Lavigne, LeBailly, Hopkins, Gouze, & Binns, 2009; Wichstrøm et al., 2012). For children with disabilities, the prevalence is higher with some researchers reporting rates of behavior problems as being 3 to 7 times the rate of children who are typically developing (Baker, Blacher, Crnic, & Edelbrock, 2002; Dykens, 2000). Of particular concern are research findings that indicate a continued trajectory of social, behavioral, and academic problems when social and emotional challenges are not resolved during the early childhood years (e.g., Brennan, Shaw, Dishion, & Wilson, 2012; Bulotsky-Shearer & Fantuzzo, 2011; Hauser-Cram & Woodman, 2016).

The increased frequency with which young children entering school display challenging behavior has resulted in an interest in providing interventions to children in the early years to promote social-emotional competence and prevent challenging behavior (Dougherty et al., 2015; Dunlap et al., 2006; National Research Council and Institute of Medicine, 2009). Unfortunately, early childhood educators have

reported they feel unequipped to meet the needs of children exhibiting social-emotional skill deficits or persistent challenging behavior (Kaufmann & Wischmann, 1999), particularly when the child has a disability (Reinke, Stormont, Herman, Puri, & Goel, 2011). A national survey of teachers in state-funded pre-kindergarten programs found that preschool children were being expelled at 3 times the rate of school-aged children (Gilliam, 2005). Recent data from the U.S. Department of Education's Office of Civil Rights reported that more than 8,000 children were suspended from public preschool programs in 2011–2012 with Black children representing the majority of those suspensions (U.S. Department of Education Office for Civil Rights Data, 2014). When surveyed, early childhood educators express a frustration with lack of preparation about how to

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intervene effectively with children who have persistent challenging behavior and a desire for implementation support focused on practices to promote children's social-emotional competence and address challenging behavior (Reinke et al., 2011; Snell, Berlin, Voorhees, Stanton-Chapman, & Hadden, 2012).

Growing national concern exists about the need to promote young children's social, emotional, and behavioral health and reduce the use of suspension and expulsion. A recent policy statement offers guidance about decreasing the use of inappropriate discipline practices and promoting the use of promotion and prevention practices to foster social-emotional competence (U.S. Department of Health and Human Services & U.S. Department of Education, 2014). The statement encourages programs to consider implementation of Positive Behavior Interventions and Support (PBIS) the *Pyramid Model for Promoting Young Children's Social-Emotional Competence* (Fox, Dunlap, Hemmeter, Joseph, & Strain, 2003; Hemmeter, Ostrosky, & Fox, 2006), a PBIS framework specifically designed for young children.

The Pyramid Model

The *Pyramid Model for Promoting Young Children's Social-Emotional Competence* (Fox et al., 2003; Hemmeter et al., 2006) is a framework for organizing research-based practices for use in early childhood classrooms to promote social-emotional competence and prevent and address children's challenging behavior. The *Pyramid Model* mirrors elements found in the three-tiered PBIS framework used in K-12 schools (Dunlap, Kincaid, Horner, Knostr, & Bradshaw, 2014). Both frameworks include the implementation of universal practices to support the active social-emotional learning and behavior of all children and youth, secondary practices to address the needs of children and youth who are at risk, and tertiary or individualized practices for children and youth who present the most persistent challenging behavior (Dunlap et al., 2014; Lewis, Adamson, Mitchell, & Lembke, 2013). *Pyramid Model* practices are research-informed interactional and instructional support practices for young children that are developmentally appropriate and designed to be implemented in a variety of classrooms (e.g., Head Start, child care, public Pre-K) that serve young children (Fox & Hemmeter, 2009; Hemmeter, Fox, & Snyder, 2013).

The *Pyramid Model* includes universal practices related to nurturing and responsive relationships and high-quality supportive environments that are critical for promoting the social-emotional competence of all children. The universal practices include joining in children's play, engaging in supportive conversations, providing encouragement and feedback to children, designing the environment and

activities to promote child engagement including teaching rules and expectations, structuring transitions, providing clear directions, and providing engaging activities (Hemmeter, Fox, & Snyder, 2014). At the universal level, teachers are also guided to promote family engagement and provide information and support to family members on the use of strategies that will promote children's social and emotional competence. The *Pyramid Model* also includes practices needed to promote the social and emotional skills of all children in the classroom with a focus on peer-related interactions, identifying and managing emotions, and social problem solving (Hemmeter et al., 2014). The secondary tier of the *Pyramid Model* guides teachers to use explicit social-emotional teaching practices to promote skill acquisition, fluency, generalization, and maintenance. The final tier of the model includes the use of intensive individualized interventions to address a child's persistent challenging behavior. At this tier, teachers are guided to develop, implement, and evaluate an individualized behavior support plan through collaborative teaming, functional assessment, and data-informed decision making (Dunlap, Wilson, Strain, & Lee, 2013).

The *Pyramid Model* was developed by examining the literature to identify effective practices that might be included in a systemic approach. Studies have examined the implementation of individual practices associated with the *Pyramid Model* (e.g., Conroy, Sutherland, Vo, Carr, & Ogston, 2014; Fox, Hemmeter, Snyder, Binder, & Clarke, 2011; Hemmeter, Snyder, Kinder, & Artman, 2011) but have not generally examined the effects on children. No published studies to date have examined the classroom-wide implementation of the *Pyramid Model* practices and effects on classroom, teacher, and child outcomes.

Professional Development (PD) to Support Implementation Fidelity of Pyramid Model Practices

Examination of the effectiveness of *Pyramid Model* practices for influencing children's social-emotional competence and addressing challenging behavior requires a competent practitioner who implements the practices with fidelity. A growing body of literature suggests that promising PD approaches include the following features: workshops, courses, or online modules and materials that provide knowledge and multiple exemplars of practices; job-embedded, sustained support related to implementing practices (i.e., coaching); feedback about practice implementation; and information linking improvements in practices to child outcomes (Kretlow & Bartholomew, 2010; Neuman & Cunningham, 2009; Snyder, Hemmeter, & McLaughlin, 2011). The use of coaching, with performance feedback, as part of a PD approach for practice change has been validated

in several preschool intervention studies with promising results (e.g., Fox et al., 2011; Hemmeter et al., 2011; Powell, Diamond, Burchinal, & Koehler, 2010).

Purpose of the Present Study

The purpose of the present study was to evaluate the potential efficacy of the classroom-wide implementation of the *Pyramid Model* practices within public school preschool classrooms. A primary research question focused on the robustness of the PD approach for supporting teachers' implementation of *Pyramid Model* practices. Second, we explored whether social and behavioral outcomes for children whose teachers participated in *Pyramid Model* PD differed from children whose teachers did not participate in this PD. For a subset of children at elevated risk for behavior disorders (referred to as "focal children"), we explored whether the frequency of social interactions or challenging behavior differed for these children when their teachers participated in the *Pyramid Model* PD versus when they did not. The primary focus of this study was on teachers' use of the *Pyramid Model* practices with all children in the classroom. While we identified focal children to determine the effects of the classroom-wide intervention on children at elevated risk for behavior disorders, individualized behavior support plans were not systematically implemented for these children. Five primary research questions were addressed:

Research Question 1: Are there differences in the fidelity of implementation of *Pyramid Model* practices between teachers who received PD on the *Pyramid Model* practices versus teachers who did not receive this PD?

Research Question 2: Are there differences in overall classroom quality between teachers who received PD on the *Pyramid Model* practices versus teachers who did not receive this PD?

Research Question 3: Do the reported post-intervention social skills and problem behavior scores of children whose teachers received PD on *Pyramid Model* practices differ from those children whose teachers did not receive PD on *Pyramid Model* practices?

Research Question 4: Are differences on post-intervention social skills and problem behavior scores between children whose teachers received PD on *Pyramid Model* practices and those children whose teachers did not receive PD on *Pyramid Model* practices moderated by pre-intervention externalizing behavior scores?

Research Question 5: Do observed social interactions and challenging behavior of focal children whose teachers have received PD on *Pyramid Model* practices differ from focal children whose teachers did not receive PD on *Pyramid Model* practices?

Method

Design

The study was a cluster-randomized controlled potential efficacy trial with children nested within teachers' classrooms. We used a mixed-model repeated-measures design with one between-subject factor (*Pyramid Model* PD condition) and one repeated-measures factor (time). Teachers were randomly assigned to experimental conditions, and the PD was delivered at the teacher level. While the unit of random assignment was at the teacher level, children were nested within teachers' classrooms. We collected repeated-measures data for both teachers and children.

Participants

Teachers were recruited by contacting the directors of the public school programs. They identified eligible teachers and we recruited from that pool of teachers. The teachers were from public preschool classrooms that served children with, at risk for, and without disabilities in two states (Tennessee and Florida). Each classroom was located in a different school to eliminate potential threats due to confounding or contamination effects. Forty teachers participated in the study (one additional teacher who consented to participate dropped out before data collection began). Two cohorts of teachers participated across the 2 years of the study. There were 18 teachers in Cohort 1 (11 in Tennessee and seven in Florida) and 22 teachers in Cohort 2 (10 in Tennessee and 12 in Florida). Teachers were randomly assigned to intervention (PD on *Pyramid Model*) and business-as-usual (control) conditions at each site with 20 teachers in each condition across sites.

Table 1 shows demographic information for the 40 teachers who participated in the study. All teachers were female, held at least a bachelor's degree, and were certified. Most teachers (62.5%) had a degree in the area of early childhood education or early childhood special education. On average, teachers in both conditions had been working in their current positions for almost 5 years. There were no statistically significant differences between groups on select demographic variables (all $p_{\text{calc}} \geq .10$). Table 2 illustrates the characteristics of the teachers' classrooms and the 494 children enrolled in those classrooms across intervention (252 children) and control conditions (242 children). There were no statistically significant differences between conditions on these classroom and child variables (all $p_{\text{calc}} \geq .18$).

We collected additional information about children who were at elevated risk for behavior disorders in each classroom. We identified these children, referred to as focal children, by asking teachers to complete the Caregiver-Teacher Report Form (C-TRF) of the Child Behavior Checklist (Achenbach & Rescorla, 2000) before intervention began

Table 1. Comparison of Teacher Demographics Across Conditions.

Variable	Control teachers (n = 20)	Intervention teachers (n = 20)	χ^2	t	p
Degree (%)					
Bachelor's	40.00	40.00			
Master's	50.00	50.00			
Master's plus 30	10.00	10.00	0.00	—	.99
Area of degree (%)					
Early childhood education/early childhood special education	60.00	65.00			
Other	40.00	35.00	0.11	—	.74
Challenging behavior training (%)					
Yes	85.00	65.00			
No	15.00	35.00	2.13	—	.14
Hours of training each year					
M	32.35	27.40			
Range	4–100	5–80	—	0.81	.42
Years working with children under kindergarten age					
M	11.53	6.96			
Range	0.08–33	0.17–24	—	1.70	.10
Time in paid teaching position (years)					
M	12.46	10.85			
Range	0.25–37	1–30	—	0.52	.61
Time in current position (years)					
M	4.52	4.75			
Range	0.08–15	0.17–17	—	-0.15	.88

Table 2. Comparison of Classroom Demographics Across Conditions.

Variable	Control teachers (n = 20)	Intervention teachers (n = 20)	t	p
Number of others beyond teacher in classroom				
Full time	1.55	1.35	0.88	.38
Part time	0.00	0.05	-1.00	.33
Number of children in classroom	13.05	12.30	0.52	.60
Age in Years (range)	3–5	2–5	—	—
Gender				
Boys	7.75	7.30	0.64	.53
Girls	5.30	5.00	0.28	.78
Ethnicity				
White, non-Hispanic	5.05	3.55	1.36	.18
African American	4.90	6.25	-0.74	.46
Hispanic	2.55	2.25	0.49	.63
Asian/Pacific Islander	0.25	0.15	0.56	.58
Other	0.30	0.10	1.38	.18
Qualify for free or reduced lunch	11.12 ^a	9.94 ^b	0.63	.54
Children with IEP/IFSP	5.70	5.50	0.17	.87
Children who are English language learners	1.85	1.80	0.09	.93
Number of children with persistent ongoing challenging behavior	2.65	2.70	-0.09	.93

Note. All values represent means with the exception of the one item reported as a range. IEP/IFSP = Individualized Education Programs/Individualized Family Service Plans.

^an = 17. ^bn = 16.

Table 3. Comparison of Demographics for Focal Children Across Conditions.

Variable	Control (<i>n</i> = 48)	Intervention (<i>n</i> = 56)	χ^2	<i>t</i>	<i>p</i>
Ethnicity (%)					
African American	31.30	42.90			
Hispanic	10.40	25.00			
White, non-Hispanic	54.20	32.10			
Asian/Pacific Islander	2.10	0.00			
Other	2.10	0.00	9.23	—	.06
Does the child qualify for free or reduced lunch? (%)					
Yes	64.60	71.40			
No	35.40	28.60	0.56	—	.46
Primary caregiver (%)					
Two parents	60.40	66.10			
One parent	33.30	32.10			
Other	6.30	1.80	1.48	—	.48
Current IEP in place (%)					
Yes	75.00	69.60			
No	25.00	30.40	0.37	—	.544
Does the child have a history or have a current behavior plan in place? ^a (%)					
Yes	28.30	28.60			
No	71.70	71.40	0.001	—	.97
Mean age	4.06	3.91	—	1.28	.21
Mean length of time teacher has known the focal child (months)	7.79	5.87	—	1.42	.16

^aControl condition *n* = 46.

for all children enrolled in their classrooms. We identified children in the classrooms who fell in either the clinical or borderline ranges on the C-TRF internalizing or externalizing groupings, total problems score, or syndrome-level scales. We used the clinical and borderline ranges provided in the C-TRF manual. We were unable to identify three focal children in 12 classrooms either because there were not three children who qualified using the C-TRF criteria or because we were unable to obtain parental consent for children who did qualify. The total number of focal children across both years of the study was 104. The mean number of focal children per classroom was 2.6, indicating the majority of classrooms had three focal children. The total number of focal children who completed the study was 97. Table 3 shows descriptive information about the focal children enrolled in intervention and control classrooms. We only had descriptive information on the focal children as we did not have parent consent for the other children in the classrooms.

Three coaches supported teachers assigned to the intervention condition. Two coaches worked at the Tennessee site and one coach worked at the Florida site. All coaches were female, and their average number of years of teaching experience was 5.8. Two of the coaches were White, non-Hispanic, and the other was Hispanic. Coaches were staff affiliated with the research project and were trained by the study principal investigators.

Intervention Condition

Teachers assigned to the intervention condition received PD focused on the *Pyramid Model* practices and how to implement these practices in their classroom. The following sections describe the components of the PD intervention.

Workshops, implementation guides, and materials. A series of small-group workshops was held at each of the two sites for each cohort of intervention teachers in the fall of each study year. The workshops were held over 3 days for 6.5 hr per day, for a total of 19.5 hr. During the workshops, each component of the *Pyramid Model* and associated practices were described and illustrated using PowerPoint® slides, video examples, case studies, and handouts. As part of the workshops, teachers received four *Pyramid Model* implementation guides with accompanying CDs and had an opportunity to discuss how they would implement the practices in their classrooms. In addition, teachers were given a variety of materials for use in implementing the *Pyramid Model* practices in the classroom, and workshop facilitators demonstrated how the materials could be used. These materials included books, puppets, posters, visual cue systems, and compact discs containing songs about friendship and emotions.

Coaching. Following the workshops, teachers in the intervention condition received individualized coaching on a weekly basis using a practice-based coaching protocol (Snyder, Hemmeter, & Fox, 2015). The coach scheduled visits with the teacher at a time convenient for the teacher and appropriate for the coach to observe the teacher's implementation of *Pyramid Model* practices.

Each coaching session had three parts: a focused observation, a debriefing meeting where reflection and feedback occurred, and a follow-up email. Coaches conducted an observation and a debriefing session in each teacher's classroom at least once a week for 12 to 16 weeks. The mean number of sessions conducted was 13.4 (range = 7–17 sessions). The goal was 13 sessions for all teachers, but this varied based on teacher attendance and other logistical issues related to the teachers and schools (e.g., health problems with teachers, school events, teacher absences).

The first three coaching sessions for each teacher were used to get to know the teacher and to develop an initial action plan. The content of the action plan was informed by data from an observation conducted in the teacher's classroom using the *Teaching Pyramid Observation Tool* (TPOT; Hemmeter, Fox, & Snyder, 2008). The TPOT observation was conducted by a naive observer, and results were provided to the coach. In addition, the content of the action plan was informed by the teacher's self-assessed strengths and needs related to her implementation of *Pyramid Model* practices and the coach's observations in the teacher's classroom during the first two coaching sessions. Working collaboratively, the teacher and coach (a) identified examples of how the teacher was currently implementing *Pyramid Model* practices, (b) identified practices that the teacher was currently not implementing or not implementing consistently, and (c) discussed strategies or actions for how the teacher would implement targeted practices.

Following the initial coaching sessions, the coach conducted an observation of the teachers' use of the practices and used notes from the observation to inform the weekly debriefing meeting with the teacher. The action plan was the focus of the observation. The debriefing involved reflection by the teacher and the coach as well as the coach providing supportive and constructive performance feedback to the teacher about observed practices. Coaches and teachers also used the action plan and implementation guides during their debriefing sessions. Action plans were updated when implementation goals were met, modified, or added.

The protocol debriefing and the follow-up email included the following components: opening comments, reflection, supportive feedback, constructive feedback (constructive feedback was not provided until after the third coaching session), targeted support, and planned actions. The coach sent an email to the teacher within 24 hr of the debriefing to summarize what occurred during

the observation and debriefing, to provide additional feedback about practice implementation, and to plan for the next coaching session.

The mean length of the observations for the initial three coaching sessions was 144 min (range = 85–205 min), and the mean length of the debriefing portion was 44 min (range = 10–135 min). The mean length of the observations after the third session was 105 min (range = 30–305 min), and the mean length of the debriefings was 44 min (range = 10–135 min). A final coaching session was held with each teacher to summarize action plan goals that had been achieved, to review progress made over the course of the study with fidelity of implementation of *Pyramid Model* practices, and to identify strategies the teacher would use to sustain practice implementation.

Control Condition

Teachers in the control condition participated in the workshop training and received guides and materials at the end of the school year after data collection ended. At each wave of data collection, we asked teachers in both groups to report PD focused on social-emotional development or challenging behavior (including support around individual children) they had received since the previous wave. For teachers in the control condition, 55% reported that they had received some PD around social-emotional development and 80% reported they had received some support around individual children with challenging behavior.

Procedural Fidelity

Several types of data were collected to measure the fidelity with which PD was implemented. Fidelity measures included information about (a) duration of and content covered in workshops; (b) duration of coaching, adherence to coaching protocol, and types of strategies used during observation and debriefing; (c) adherence to email protocol; and (d) other PD the teachers participated in during the study. Fidelity was measured for all workshop sessions and for at least 25% of all coaching sessions and email feedback documents. Fidelity of the training was measured live, and for the coaching, it was measured from audiotapes. Fidelity protocols that were developed for this study were used. Data collectors who conducted the fidelity checks were not involved in the coaching or training of the teachers. Across sites, training fidelity for the workshops was 97% in Year 1 and 98% in Year 2. Coaching fidelity was collected on 33% of the coaching debriefing sessions ($n = 90$) and ranged from 45.5% to 100%, with a mean of 87.4%. Fidelity of email feedback documents was examined for 36% of emails ($n = 78$) and ranged from 37.5% to 100%, with an average fidelity of 88.6%.

Focus Groups

At the end of both study years, we conducted focus groups with teachers in the intervention condition. The focus groups provided a forum for teachers to share their experiences and perspectives about the PD they received and the impact of the intervention on their teaching, capacity to support children, and the value of the *Pyramid Model* practices.

Measure

TPOT. The TPOT (Hemmeter et al., 2008) is an instrument designed to measure the fidelity with which teachers implement practices related to each component of the *Pyramid Model*. It is administered by conducting an approximately 2-hr observation and 15- to 20-min interview with teachers. The version of the TPOT used in the present study had 108 indicators organized under 15 key *Pyramid Model* practice items. Indicators are scored either *yes* (practice was observed or reported to be implemented during the interview) or *no* (practice was not observed or not reported to be implemented during the interview). In addition to key practice items, 16 red flags, seven environmental arrangement indicators, and one item with 10 indicators related to a teacher's responses to challenging behavior were included on this version of the TPOT. Red flags are practices that are either inconsistent or incompatible with *Pyramid Model* practices. The range of scores for key practice items was 0 to 108, for red flags was 0 to 16, and for environmental arrangements was 0 to 7.

The psychometric properties of this version of the TPOT were examined as part of a study involving 50 preschool classrooms that were not part of the potential efficacy trial (Snyder, Hemmeter, Fox, Crowe Bishop, & Miller, 2013). Results from generalizability analyses showed minimal error variance (i.e., less than 1%) attributed to occasions and raters and the *G* coefficient was .94, averaging over occasions and raters. With respect to convergent score validity, the Pearson product-moment correlation coefficients between total TPOT key practice scores and composite domain scores for the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008) were .70 for emotional support, .73 for classroom organization, and .76 for instructional support.

CLASS. The CLASS measures classroom organization, instructional support, and emotional support and has 10 dimensions: positive/negative emotional climate, teacher sensitivity, regard for students' perspectives, effective behavior management, productive use of time, concept development, instructional learning formats, quality of feedback, and language modeling.

C-TRF. The C-TRF (Achenbach & Rescorla, 2000) is a 99-item measure designed to assess the behavioral, emotional, and social functioning of children ages 1.5 to 5 years. The C-TRF provides a profile indicating the degree to which the child is at risk for a behavior problem/disorder and the severity of the problems. The test-retest score reliability on total problems is $r = .90$, and the test-retest reliability for scale scores ranges from .68 to .92 with a mean of .85. Studies have documented the construct validity of C-TRF scores and score validity evidence based on relationships with other measures (Achenbach & Rescorla, 2000).

Social Skills Improvement System (SSIS). The SSIS (Gresham & Elliott, 2008) is used for teachers to report about the social skills and problem behaviors of children. The normative sample for the SSIS was a representative national sample of 950 children between the ages of 3 and 18, including 200 preschoolers. On the SSIS, preschool children are assessed on two key domains: social skills and problem behaviors. For the national sample of 950 children, internal consistency score reliability (Cronbach's α) ranged from .75 to .97 with a median of .96. Test-retest score reliability on the Teacher Form had a median correlation of .84 (range = .74–.93; Gresham & Elliott, 2008).

Focal Child Observation System (FCOS). A project-developed direct observation system was used to collect data on social interaction skills of the focal children. Each focal child was observed for 60 min across three types of activities (i.e., structured, unstructured, and transition) during each data collection wave. Event-code behaviors observed were positive social initiations and responses to peers, positive social initiations and responses to adults, physical aggression directed to adults, physical aggression directed to peers, verbal aggression to adults, verbal aggression to peers, and other disruptive behaviors. Aggressive and disruptive behaviors lasting longer than 3 s were coded for the duration of the behavior. For the present study, we created two summary variables from the event codes that were used in substantive analyses: (a) positive social interactions and (b) challenging behavior. Direct observation data were collected using the MOOSES program (Tapp, Wehby, & Ellis, 1995) on handheld personal digital assistants.

Data Collection Procedures

All measures were administered in both intervention and control classrooms. All data were collected by observers who were naive to the condition to which the teacher had been assigned.

Data collection schedule. Before beginning the study, demographic information on the classroom and teachers were collected and teachers completed the C-TRF (Achenbach &

Rescorla, 2000) on all children. Data on the TPOT and CLASS were collected on four occasions: (a) Wave 1 was 5 to 7 weeks after school began and before the PD intervention was implemented (September/October); (b) Wave 2 was in November/December after workshops were completed and coaching had begun; (c) Wave 3 was in January to March, while coaching was still being implemented; and (d) Wave 4 was in March/April/May, which was at least 4 weeks after PD ended and at least 3 weeks prior to the end of the school year. The SSIS was completed for all children at Wave 1 and Wave 4, and the FCOS was completed at Waves 2, 3, and 4. SSIS data were collected on all children; FCOS data were collected only on focal children.

Data collector training. Training for data collectors was conducted by project staff on TPOT and FCOS and by a certified CLASS trainer for the CLASS measure. Data collectors were required to achieve at least 80% agreement with another data collector for at least three observations for each measure. Subsequent to within-site training, we held a cross-site meeting and observers across sites conducted CLASS, TPOT, and FCOS classroom observations together. We examined inter-rater agreement for each CLASS, TPOT, and FCOS observation. Data collectors from each site were required to reach at least 80% agreement with each other for at least three TPOT and three FCOS classroom observations.

Inter-Observer Agreement (IOA)

During the study, IOA data were collected on all measures, all teachers, and all observers for at least 25% of the observations. IOA data were collected on 46.20% (73/158) of CLASS observations. The average IOA for CLASS observations was 91.1% with a range from 67.5% to 100%. IOA data were collected on 44.9% (71/158) of all TPOT observations. Inter-rater agreement at the indicator level averaged 86.8% with a range of 70.2% to 99.2%. For the FCOS, IOA data were collected on 43.71% (153/350) of sessions. Inter-rater agreement for FCOS codes ranged from 89% to 100% across behaviors coded.

Analyses

Descriptive and inferential analyses were conducted to examine whether random assignment procedures resulted in comparable groups of teachers and children. To address each research question, inferential analyses were conducted using Mplus 7.31 and were conducted using full information maximum likelihood estimation with robust standard errors. Effect sizes reported are Cohen's *d*. We made the following directional hypotheses about performance of teachers and their children in the intervention condition compared with the performance of teachers and their children in the control condition: (a) higher mean TPOT, social skills (SSIS), and positive

social interactions (FCOS) scores and (b) lower mean problem behavior (SSIS) and challenging behavior (FCOS) scores. Therefore, main effect treatment comparisons for variables from the TPOT, SSIS, and FCOS were conducted using directional tests. For these variables, reported *p* values for univariate tests are one tailed. Main effect treatment comparisons for variables on the CLASS were conducted using non-directional tests. For analyses reported in the present article, alpha was established as .05. To investigate differences between experimental conditions on teachers' implementation of *Pyramid Model* practices (i.e., TPOT scores), we used a MANCOVA model with TPOT Wave 1 scores as the covariate in these analyses. The same method of analysis was used for each of the CLASS domain and dimension scores.

To examine whether the social and behavioral skills of children whose teachers who received PD on the *Pyramid Model* differed from children whose teachers were in the control condition, multilevel modeling was used to account for children nested in teachers' classrooms and to examine interaction and main effects. Child pre-test SSIS scores for problem behavior or social skills (centered to the classroom mean) were used as predictors at Level 1. Classroom mean pre-test SSIS scores for problem behavior or social skills were used as predictors at Level 2. Prior to testing for treatment main effects, Pre-Test \times Treatment interactions at Levels 1 and 2 for problem behavior or social skills were tested. In addition, to explore moderation of treatment effects, C-TRF Externalizing scores (centered to the classroom mean) were added as predictors at Level 1, classroom mean C-TRF Externalizing scores were added as predictors at Level 2, and a model with C-TRF Externalizing \times Treatment interactions at Levels 1 and 2 was estimated. To investigate differences between experimental conditions on focal child social interaction skills and challenging behavior as measured by the FCOS, we used a MANOVA model to examine main effects subsequent to the pre-intervention measurement occasion (i.e., Wave 1).

Results

The initial wave of measures allowed us to examine whether there were statistically significant or noteworthy differences between groups prior to the beginning of the intervention. For the TPOT, differences at Wave 1 favored the control group teachers ($p = .052$). On the SSIS, there were no statistically significant differences in social skills or problem behavior between children in the two conditions. Covariate \times Condition interaction tests were not statistically significant for the TPOT total, SSIS social skills, and SSIS problem behavior scores. Therefore, results reported below for these variables refer to tests of the condition main effects. Table 4 shows the unadjusted means for all dependent measures used in the present study across data collection waves and by condition.

Table 4. Unadjusted Means for Primary Study Measures.

Variable	Participants	Treatment group	Wave 1			Wave 2			Wave 3			Wave 4		
			n	M	SD	n	M	SD	n	M	SD	n	M	SD
TPOT	Teachers	BAU	20	45.6	14.8	19	41.3	11.4	19	44.6	13.4	20	44.2	14.8
		Pyramid	20	37.0	13.9	20	43.2	13.3	20	56.3	18.9	20	69.9	17.5
CLASS-CO	Teachers	BAU	20	4.83	0.80	19	4.81	0.73	19	4.57	0.98	20	4.80	0.79
		Pyramid	20	4.27	0.85	20	4.57	0.96	20	4.84	0.83	20	5.07	0.78
CLASS-ES		BAU	20	5.24	0.76	19	5.24	0.88	19	5.08	0.99	20	5.35	0.84
		Pyramid	20	4.74	1.02	20	4.98	0.88	20	5.31	0.67	20	5.49	0.71
CLASS-IS		BAU	20	2.32	0.97	19	2.33	0.81	19	2.17	0.52	20	2.11	0.66
		Pyramid	20	1.93	0.78	20	2.11	0.81	20	2.34	0.91	20	2.06	0.63
C-TRF externalizing	All children	BAU	244	51.3	10.1									
		Pyramid	259	50.6	10.0									
SSIS problem behavior	All children	BAU	252	104.2	14.0							226	103.0	15.2
		Pyramid	240	103.1	16.7							211	97.4	14.4
SSIS social skills	Focal children	BAU	252	89.9	16.4							223	94.3	16.3
		Pyramid	239	86.9	19.2							212	99.4	17.0
FCOS SI	Focal children	BAU				48	17.9	15.5	44	15.9	13.0	43	15.6	11.8
		Pyramid				56	17.5	11.1	56	18.2	15.5	54	19.9	15.1
FCOS behavior	Focal children	BAU				48	9.4	15.2	44	7.2	8.1	43	8.1	10.9
		Pyramid				56	13.6	14.4	56	7.5	7.8	54	7.1	8.6

Note. TPOT = Teaching Pyramid Observation Tool; BAU = business-as-usual control condition; Pyramid = intervention condition; CLASS = Classroom Assessment Scoring System; CO = classroom organization; ES = emotional support; IS = instructional support; C-TRF = Caregiver-Teacher Report Form; SSIS = Social Skills Improvement System Rating Scale; FCOS = Focal Child Observation System; SI = social interaction.

TPOT—Fidelity of Implementation of Pyramid Model Practices

Training and coaching for the teachers in the intervention condition began following Wave 1 data collection. On average, teachers received 3.4 (range = 1–5) coaching visits prior to Wave 2 data collection. Table 4 shows unadjusted means for the TPOT across waves and across intervention and control groups. Teachers in the intervention group made steady progress toward higher levels of implementation of *Pyramid Model* practices when compared with teachers in the control group. The multivariate Wald test of the treatment main effect was statistically significant, $\chi^2(3) = 61.65, p < .001$. Using the Bonferroni test, the adjusted mean for the intervention group was significantly higher than the adjusted mean for the control group at all three waves. Adjusted means for the control and intervention groups, respectively, by wave were (a) Wave 2: 38.3 and 45.6, $z = 2.25, p = .013$, and $d = 0.59$; (b) Wave 3: 40.3 and 59.9, $z = 5.24, p < .001$, and $d = 1.21$; and (c) Wave 4: 41.6 and 72.5, $z = 6.18, p < .001$, and $d = 1.95$.

Classroom Quality: CLASS

Among all CLASS variables, five exhibited significant multivariate Wald interaction tests and a significant univariate interaction test based on the Bonferroni test applied

separately to each variable: emotional support, positive climate, negative climate, regard for student perspectives, and productivity. The interaction was significant at Wave 3 for emotional support and positive climate, at Wave 4 for negative climate and regard for student perspectives, and at Wave 2 for productivity. In general, plots of regression lines for each variable indicated that the mean for the intervention group was higher than the mean for the control group among classes that had low Wave 1 scores. Given the wave for which the interaction tests were significant differed across variables, we chose not to interpret the interactions.

For emotional support, positive climate, negative climate, regard for student perspectives, and productivity, we revised the model that included the Covariate \times Condition interaction at each wave by excluding the interaction for the waves at which the interaction was non-significant. For these variables, there was a significant multivariate Wald test of the main effect for Emotional Support, $\chi^2(3) = 8.242, p = .041$. The adjusted mean was higher at Wave 3 using the Bonferroni procedure, $z = 2.48, p = .007, d = 0.67$. For the remaining variables, only Behavior Management exhibited a significant multivariate Wald test of the main effect, $\chi^2(3) = 7.908, p = .048$. Using the Bonferroni test, the adjusted mean for the *Pyramid Model* group was significantly higher at Wave 4, $z = 2.50, p = .006, d = 0.66$, with adjusted means equal to 5.5 and 4.9 for the *Pyramid Model* and control groups, respectively.

SSIS Social Skills/Problem Behavior

No Pre-Test \times Treatment interactions were statistically significant at Level 1 or 2 for problem behavior or social skills, and therefore, non-statistically significant interaction effects were removed from the model. Children in the intervention group had higher scores on post-test SSIS social skills when compared with children in the control group (evidenced by statistically significant and noteworthy main effect, $z = 2.92$, $p = .002$, $d = 0.43$). Adjusted means were 92.1 for the control group and 99.3 for the *Pyramid Model* group. Children in the intervention group also had lower SSIS problem behavior post-test scores when compared with children in the control group: $z = -1.84$, $p = .032$, $d = -0.29$). Adjusted means were 103.7 for the control group and 99.2 for the intervention group. (Lower standard scores on SSIS problem behavior scale are desirable.) Inclusion of C-TRF externalizing scores as a covariate and Externalizing \times Treatment interactions at Levels 1 and 2 to explore moderation did not result in significant Externalizing \times Treatment interactions at Level 1 or 2.

Focal Child Observation System

Multivariate Wald tests of the treatment effect were not significant for frequency of social interaction skills or challenging behaviors. At Wave 4, differences in the mean observed social interaction skills of focal children in the intervention versus the control group did not reach statistical significance against $\alpha = .05$ ($z = 1.41$, $p = .079$) although the effect size was moderate ($d = 0.32$). The mean for intervention group focal children was 19.9 social initiations or responses versus 15.6 for control group focal children. For frequency of challenging behaviors, means at Wave 4 were 8.1 for the control group and 7.1 for the intervention group ($d = -0.09$).

Social Validity

Teachers who participated in the intervention were universally positive about the PD they received and the outcomes that resulted from their implementation of the *Pyramid Model* practices. Teachers reported the training was inspiring and practical, particularly seeing videos of teachers implementing the practices. They also reported that the implementation guides and related materials were user-friendly and critical to implementation. Teachers felt coaching was essential to their implementation of the *Pyramid Model*. In particular, they valued the support and feedback, creation of action plans, hands-on assistance, and positive supportive relationship. In the discussion, teachers offered multiple examples of how coaching helped them try new strategies and understand how the strategies could be used with their children. Multiple teachers reflected that they

would continue to use the practices the following school year without the support of the coach.

When discussing the outcomes of implementation, teachers shared that children had fewer problem behaviors, stronger social skills, and took more ownership of the classroom. In addition, teachers reported that their teaching team members also began to use the *Pyramid Model* practices. Teachers said the practices helped them communicate more with children, be more patient, and be a better teacher.

Discussion

This study provides an evaluation of the potential efficacy of classroom-wide implementation of *Pyramid Model* practices within public school early childhood classrooms. The evaluation included analyses of the effects of PD on teachers' fidelity of implementation of *Pyramid Model* practices and corollary effects on social skills and problem behavior of children in teachers' classrooms. This study is the first experimental evaluation of the *Pyramid Model*, a classroom-wide positive behavior support approach for developing young children's social-emotional competence and preventing and addressing their challenging behavior.

The PD in the present study consisted of small, individualized group training workshops; implementation materials and guides; and practice-based coaching. Analyses were conducted to determine whether there were differences between teachers who received the PD and teachers in the control condition on their implementation of *Pyramid Model* practices. On average, teachers in the control group made little progress toward implementing more *Pyramid Model* practices over time, whereas teachers who received PD made steady progress toward higher levels of practice implementation. The differences in practice implementation between the two groups were statistically significant and noteworthy beginning at Wave 2, favoring the *Pyramid Model* group. By Wave 4, there was almost a 2 *SD*-unit difference between implementation of *Pyramid Model* practices across groups as measured on the TPOT. From a practical perspective, by Wave 4, on average, teachers in the intervention condition implemented 69.9% of the practices represented on the TPOT, whereas teachers in the control condition implemented only 44.2% of these practices.

Findings related to classroom interactional and instructional quality using the CLASS showed higher levels of emotional support in intervention classrooms, indicating that these teachers generally fostered a more positive climate, were more aware and responsive to students' academic and emotional concerns, and demonstrated regard for children's interests, motivations, and points of view relative to teachers in the control condition. *Pyramid Model* practices at the universal level emphasize responsive and nurturing interactions between adults and children, including practices that create a positive emotional climate. In

addition, teachers in the intervention condition scored higher on the behavior management dimension of the CLASS. This dimension focuses on the extent to which teachers establish clear behavior expectations, are proactive about anticipating problem behavior and demonstrate low reactivity when it occurs, use effective strategies to redirect problem behavior, and are successful in managing behavior so there are few observed instances of problem behavior in their classroom.

Taken together, TPOT and CLASS data provide promising evidence that the combination of high-quality training, implementation guides and materials, and practice-based coaching was associated with teachers' fidelity of implementation of *Pyramid Model* practices. The present study adds to a growing body of research that PD focused on improving teachers' implementation of practices is likely to be effective when it (a) explicitly defines observable indicators of the practices, (b) provides multiple exemplars of what the practices look like when implemented in the classroom, (c) provides teachers with opportunities to learn about and implement the practices with explicit feedback about implementation, and (d) includes information that links changes in teachers' practices to child progress monitoring and child learning outcomes (Diamond, Justice, Siegler, & Snyder, 2013; Snyder et al., 2011).

Child outcome data showed that children whose teachers were in the intervention group were rated significantly higher on their social skills than children whose teachers were in the control group. There also were statistically significant and noteworthy differences between these two groups of children on problem behavior. Children in the intervention group had fewer problem behaviors as reported by their teachers. The effects of the *Pyramid Model* intervention on children's social and emotional outcomes as measured by the SSIS were not moderated by pre-intervention externalizing behavior. These findings are particularly encouraging given the *Pyramid Model* was designed to be an efficient classroom-wide approach for supporting all young children's social-emotional development and preventing their challenging behavior. In the *Pyramid Model*, social-emotional teaching practices are implemented within and across classroom activities and routines versus only during small-group instruction. In future studies of the *Pyramid Model*, if similar effects for children's social and behavioral skills are found, it might suggest not only the efficacy but also the efficiency of integrating social-emotional teaching strategies universally throughout the curriculum rather than only providing targeted instruction to children who are not evidencing social, emotional, or behavioral challenges.

There were no statistically significant differences between the two groups of focal children on the direct observations of their social interaction skills and problem behavior, but the standardized difference effect size for

social interaction skills was moderate. Children in the intervention group made more frequent social initiations or responses when compared with children in the control group. These findings suggest that although classroom-wide practices might yield some benefits for children at risk for behavior disorders, more targeted teaching practices and individualized behavior support plans should be developed and monitored for fidelity of implementation for these children along with the classroom-wide practices being used for all children (Dunlap et al., 2013).

Although teacher-reported challenging behavior decreased, the direct observation measure did not demonstrate significant changes in challenging behavior for focal children. There are a number of possible explanations for this finding. First, the PD the teachers received was focused primarily on classroom-wide implementation of the *Pyramid Model* practices. It is possible that teachers' implementation of these practices was not intensive or individualized enough for the children with significant challenging behavior and that the individualized behavior support component of the *Pyramid Model* was not implemented with enough specificity and intensity to significantly change a focal child's challenging behavior. Second, this finding could be related to measurement issues related to observing challenging behavior of focal children. We did not focus the observations of focal children on the specific activities in which each child was most likely to engage in challenging behavior. Instead, we observed the same activity types for all focal children. In addition, we may not have conducted enough observations to obtain a reliable measure of focal children's challenging behavior. Our interpretations of these findings are that they confirm the need for classroom-wide practices as well as individually designed interventions and the importance of monitoring intervention fidelity of the individualized supports provided to children with the most persistent challenging behavior.

The magnitudes of the distal child outcome effects favoring the intervention group generally are consistent with those reported in other studies focused on providing a PD intervention to teachers to improve their practices and, in turn, affect child developmental and learning outcomes (Landry, Anthony, Swank, & Monseque-Bailey, 2009; Powell et al., 2010; Ramey et al., 2011). However, these small-to-moderate child-level effects are not as robust as might be desired (Hill, Beisiegel, & Jacob, 2013). In the present study, administering post-intervention child outcome measures relatively close in time to when teachers in the intervention group began implementing more *Pyramid Model* practices might not have been optimal. Stronger effects might have been found if children's social and behavioral skills were evaluated after their teachers had sustained or improved their implementation of *Pyramid Model* practices for a longer period of time.

Given the present study was a potential efficacy trial, there were several limitations that should be addressed in future studies. First, our primary measure of social skills and problem behavior was a teacher-report measure. Teachers in the intervention condition could have been differentially “sensitized” to the potential relationships between implementation of *Pyramid Model* practices and children’s social skills and problem behaviors. However, because most measures that are used to discuss the prevalence of challenging behavior are based on teacher report, changes in teacher report suggest an important finding in terms of practical significance. Second, FCOS data were not gathered in the specific activities in which focal children were most likely to exhibit challenging behavior. Third, there were limitations with the TPOT. It is not designed to measure the fidelity with which individualized behavior supports are delivered to children with persistent behavior challenges. Furthermore, the TPOT does not provide information about the dose of practice implementation. The final limitation relates to the teachers who participated in this study. They were highly qualified, certified teachers. They represent only one segment of the early childhood workforce, and further work will be needed to understand how the workshops and coaching model will work with a different segment of the workforce.

Despite these limitations, findings from this potential efficacy study contribute to the literature in several ways. First, the findings demonstrate that quality PD can be effective for increasing teachers’ implementation of evidence-based practices. Second, the findings demonstrate that practices associated with a comprehensive social-emotional framework can be implemented with fidelity following high-quality PD. Finally, the study provides evidence that practices associated with the *Pyramid Model* framework can be effective for promoting social and behavioral skills of all children in a classroom.

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