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Measuring Teacher Implementation of the *BEST in CLASS* Intervention Program and Corollary Child Outcomes

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Abstract

This study is part of a larger randomized efficacy trial examining the impact of Behavioral, Emotional, and Social Training: Competent Learners Achieving School Success (*BEST in CLASS*), a Tier 2 intervention that targets the prevention of emotional/behavioral disorders in young, high risk children. In this investigation, we examined teachers' implementation and maintenance of instructional practices in early childhood classrooms and the corollary relationships between teacher implementation of the specific instructional practices associated with *BEST in CLASS* and child engagement and problem behaviors. Fifty-three teachers (26 in treatment and 27 in comparison) and 130 preschool-aged children (66 in treatment and 64 in comparison) participated. Findings indicated that teachers' who received training and coaching in the *BEST in CLASS* intervention increased their use of specific instructional practices in comparison with teachers in the control condition. In addition, children whose teachers' received the *BEST in CLASS* intervention demonstrated increased engagement and a decrease in problem behaviors in comparison with those children who were in the control group. Positive teacher–child interactions increased and negative teacher–child interactions decreased in the intervention group in comparison with the control group. Results are discussed in relation to measuring teachers' implementation of instructional practices and implementation science.

The number of young children in early childhood settings exhibiting problem behavior that interferes with social/emotional development continues to rise (Brauner & Stephens, 2006; Carter et al., 2010; L. A. McCabe & Frede, 2007). Reported prevalence rates suggest that as many as 14% to 30% of preschool children demonstrate significant problem behavior and these rates are higher for children living in poverty (Barbarin, 2007; Feil et al., 2005; Qi & Kaiser, 2003). Evidence clearly shows that early problem behavior is alterable with early intervention (Dunlap et al., 2006; Maag & Katsiyannis, 2009); thus, intervention should begin as soon as risk factors present (Webster-Stratton & Taylor, 2001). Unfortunately, many of these young children will not receive the early intervention/prevention services they need to ameliorate and change the trajectory of problem behavior and promote social competence (Conroy & Brown, 2004). This limited access to needed services is alarming as the early childhood years are an important time for social/emotional development, and early prosocial behavior is linked to later social outcomes and academic success (P. McCabe & Altamura, 2011).

When children develop effective social and behavioral regulation skills, instances of problem behavior decrease (Blandon, Calkins, Grimm, Keane, & O'Brien, 2010). The early development of social, emotional, and behavioral competence may even prevent the onset of persistent problem behavior (Bornstein, Chun-Shin, & Haynes, 2010). Conversely, if children begin to engage in problem behavior early, and these behaviors are left unaddressed, the negative impacts are evident both short- and long- term. For example, preschoolers who consistently engage in problem behavior experience poor academic outcomes (Bulotsky-Shearer, Bell, & Dominguez, 2012; Bulotsky-Shearer, Dominguez, & Bell, 2012) and negative

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interactions with teachers and peers (Bulotsky-Shearer, Bell, Romero, & Carter, 2012; Bulotsky-Shearer, Dominguez, & Bell, 2012), especially when these behaviors occur during teacher-facilitated learning activities (Bulotsky-Shearer, Fantuzzo, & McDermott, 2008; Bulotsky-Shearer, Fantuzzo, & McDermott, 2010), which is a common time for disruptions (Qi, Kaiser, & Milan, 2006). These negative experiences in the early years tend to persist as children continue to demonstrate problem behavior and underperform academically once they enter school (Bub, McCartney, & Willett, 2007; Hamre & Pianta, 2001). These persistent problem behaviors and subsequent academic difficulties are linked to future internalizing (Burt & Roisman, 2010; Obradovic, Burt, & Masten, 2010) and externalizing problem behaviors (Darney, Reinke, Herman, Stormont, & Ialongo, 2013; Fanti & Henrich, 2010; Reinke, Herman, Petras, & Ialongo, 2008). Because these early problem behaviors are indicative of more serious behaviors later (see Dunlap et al., 2006), early identification and intervention/prevention are a priority.

Researchers have demonstrated that interactions children have with their teachers are highly influential. Depending on the nature of these interactions, the impact on a child's social, emotional, behavioral, and developmental outcomes can be either positive or negative (Conroy, Sutherland, Haydon, Stormont, & Harmon, 2008). When young children at risk for developing behavior problems and their teachers engage in positive interactions, child behavior and academic performance improves (Baker, 2006; Birch & Ladd, 1998; Hamre & Pianta, 2001), indicating that, over time, positive teacher–child interactions can produce a "protective effect" (Baker, 2006, pp. 24). Moreover, when teachers provide high levels of emotional support, children at risk for behavior problems demonstrate fewer problem behaviors (Dominguez, Vitiello, Fuccillo, Greenfield, & Bulotsky-Shearer, 2011), engage in more positive interactions with teachers (Dominguez et al., 2011; Hamre & Pianta, 2005), and achieve academically (Hamre & Pianta, 2005). Thus, secure relationships can form with teachers through sustained positive teacher–child interactions and can serve as a foundation for future academic and social/emotional development (P. McCabe & Altamura, 2011).

Clearly, evidence of the dismal effects persistent problem behavior can have on learning, social, emotional, and behavioral development and future life outcomes highlights the critical importance of early intervention for children at risk for emotional/behavior disorders (EBD; Conroy & Brown, 2004; Dunlap et al., 2006; Maag & Katsiyannis, 2009). Moreover, the accumulation of research indicates that teachers' implementation of evidence-based practices can have a positive impact on child behavior, learning, and outcomes (Conroy, Dunlap, Clarke, & Alter, 2005; Conroy, Stichter, Daunic, & Haydon, 2008; Maag & Katsiyannis, 2009). Despite the emphasis on evidence-based practices, a

research to practice gap still exists (Cook, Cook, & Landrum, 2013; Cook & Odom, 2013). In general, full implementation of early intervention programs in early childhood settings is rare or implementation occurs with a large degree of variability (Durlak, 2010), and this vexing problem is often cited in the literature and linked to a number of application problems, including lack of feasibility, perceived relevance, and available supports for successful implementation (Cook & Odom, 2013). Both the variation noted in implementation of early intervention programs, as well as the positive outcomes associated with well-implemented evidence-based programs, have contributed to the increasing focus on implementation science, which seeks to explore and explain how and why interventions work in real-world contexts (Kelly & Perkins, 2012). Because child behavior is highly influenced by teacher behavior, there is a need for classroom-based interventions that not only assist children in building the social and behavioral competence skills they require to be successful in school, but also to help teachers implement evidence-based instructional practices with a high level of fidelity. The Behavioral, Emotional, and Social Training: Competent Learners Achieving School Success (*BEST in CLASS*) intervention was designed to address this gap in the literature.

BEST in CLASS is a classroom-based intervention comprised of effective, evidence-based instructional practices designed to (a) prevent and ameliorate young children's chronic problem behaviors, (b) enhance positive teacher–child interactions, and (c) promote social and behavioral competence in young children at risk for EBD. Conceptualized as a "value-added" intervention, *BEST in CLASS* targets increase the quantity and quality of key instructional practices that have been demonstrated to prevent and reduce the occurrence of problem behaviors. Through professional development activities, including practice-based coaching and performance feedback, early childhood teachers' learn how to intentionally use and link these key practices with targeted children in their classrooms. The *BEST in CLASS* intervention is comprised of seven instructional modules, including (a) *Rules*, (b) *Behavior Specific Praise*, (c) *Precorrection*, (d) *Opportunities to Respond*, (e) *Teacher Corrective Feedback*, (f) *Teacher Instructive Feedback*, and (g) *Linking and Mastery*. Teachers are trained via a 6-hr workshop that uses both didactic and interactive learning activities. These learning activities focus on providing a rationale for the individual learning modules, video examples of strategy implementation, and opportunities to practice. The teachers are provided a training manual that summarizes the primary content of the training and serves as a framework for the skill acquisition and mastery that is supported by 14 weeks of practice-based coaching, where teachers receive weekly data-based feedback on their implementation of each *BEST in CLASS* modules (see Note 1).

Although several quasi-experimental studies have provided initial evidence on the impact of *BEST in CLASS* on children's social and behavioral outcomes (i.e., see Conroy, Sutherland, Vo, Carr, & Ogston, 2014; Vo, Sutherland, & Conroy, 2012), the current study is part of a larger randomized efficacy trial examining the impact of *BEST in CLASS* on children's social and behavioral outcomes. Given the importance of teachers' implementation of the *BEST of CLASS* intervention with fidelity and the potential impact on teacher–child interactions and child outcomes, the current investigation sought to examine the effects of the *BEST in CLASS* intervention on teachers' implementation and maintenance of instructional practices in early childhood classrooms. In addition, corollary relationships between teacher implementation of the specific instructional practices associated with *BEST in CLASS* and child engagement, problem behaviors, and teacher–child interactions were explored. The following research questions were addressed:

> **Research Question 1:** What is the effect of specific instruction and practice-based coaching on teacher's implementation and maintenance of instructional practices associated with the *BEST in CLASS* intervention in early childhood classroom settings?
> **Research Question 2:** Were there corollary relationships between teacher implementation of specific instructional practices associated with the *BEST in CLASS* intervention and child engagement and problem behaviors?

Method

Setting

The study took place in federally or state-funded early childhood classrooms (e.g., Head Start, Title I, state-funded prekindergarten) serving children (ages 3 to 5 years old) who were at risk for school failure due to a variety of factors (e.g., socioeconomic status). The classrooms were located across two southeastern states and four school districts. In one state, classrooms were part of a Head Start program run through a moderate size school district serving seven towns in both suburban and rural communities. The Head Start program serves approximately 640 children, and 99% are living in poverty. In the other state, classrooms were located in one of three regional school districts (one urban and two large suburban districts). One school district served over 1,600 preschool-aged children in approximately 95 early childhood classrooms. The second school district served over 680 preschool-aged children in approximately 38 early childhood classrooms. The final district served over 420 preschool-aged students in 26 early childhood classrooms. Across all classroom sites a variety of different early childhood curricula were used, with the most common being the Creative Curriculum for Preschool®, the High Scope Early Childhood Curriculum, and Second Step: Social-Emotional Skills for Early Learning.

Participants

The primary participants in this study were early childhood teachers who volunteered to participate through informed consent and worked in federally or state-funded early childhood program serving young children (ages 3–5 years old) who are at risk for school failure. Child participants in each classroom were selected through a systematic screening process, which included administration of the *Early Screening Project* (*ESP*; Feil, Severson, & Walker, 1998) Stages 1 and 2, which was used to determine risk for EBD, and the *Battelle Developmental Inventory, Second Edition Screener* (*BDI-II* Screener; Newborg, 2005), which was used to rule out a cognitive developmental disability. First, teachers completed the ESP-Stage 1 by rank ordering five children in their classroom based on externalizing behaviors. If informed consent was obtained on a child who was nominated by the ESP-Stage 1, the second stage of the ESP was administered to determine if the child scored at risk for EBD. After risk status for EBD was confirmed, the *BDI-II* was administered to assure that children's cognitive developmental abilities were within or above average range. Depending on the number of children who met eligibility criteria (as listed below), the top three children who scored at the highest risk level for EBD participated in the study.

Teachers. A total of 53 female early childhood teachers served as participants. Of these teachers, 26 participated in the *BEST in CLASS* intervention group and 27 in the comparison group. Eighteen teachers held an associate's degree, 22 held a bachelor's degree, and 13 held a master's degree. Participating teachers had an average of 14 years of teaching experience, with a range of 0 to 38 years. Race varied with 23 teachers African American, 28 Caucasian, one Hispanic, and one other.

Children. One hundred thirty preschool-aged children participated in the study (66 in *BEST in CLASS* intervention condition and 64 in comparison classrooms). To participate in the study, all children met the following eligibility criteria: (a) enrolled in a federal or state-funded early childhood classroom (e.g., Head Start or state-funded early childhood program) with a participating teacher, (b) were found to be at elevated risk for EBD as indicated by the ESP (Feil et al., 1998), (c) did not demonstrate any cognitive developmental delays as indicated by the *BDI-II* (Newborg, 2005), and (d) displayed problem behaviors in the early childhood setting. Eighty-three child participants were male and 47 were female. At the beginning of the study, the majority of the

Table 1. Participant Characteristics.

Child demographics	Treatment	Control	Total
Gender			
Male	45	38	83
Female	21	26	47
Age			
2 years	0	1	1
3 years	10	9	19
4 years	49	47	96
5 years	7	7	14
Race			
African American	51	46	97
White	9	10	19
Hispanic	2	3	5
Multi	3	5	8
Missing	1	0	1

Teacher demographics	Treatment	Control	Total
Highest degree			
Associate	7	11	18
Bachelor's	12	10	22
Master's	7	6	13
Years teaching experience			
Mean	15	13	14
Range	0–38	0–35	0–38
Race			
African American	11	12	23
White	13	15	28
Hispanic	1	0	1
Other	1	0	1

children were 4 years old (*n* = 96) and African American (*n* = 97; see Table 1).

Materials

The *BEST in CLASS* intervention is implemented through three interactive components: (a) *the BEST in CLASS Workshop*, (b) *the BEST in CLASS Teacher Manual*, and (c) *BEST in CLASS Practice-based Coaching*. As described earlier, the *BEST in CLASS* workshop introduces the intervention model in a 6-hr interactive workshop format. The *BEST in CLASS Teacher Manual* provides an overview of each of the key effective instructional practices, guidelines for implementing each practice with children at high risk for EBD in classrooms settings, strategies for communicating with participating children's caregivers about using these practices at home, and the role of the *BEST in CLASS* coach. The *BEST in CLASS Practice-Based Coaching Manual* provides information for coaches on how to enhance and support teachers' use of specific strategies using a collaborative coaching model (see Note 2).

Behavioral Observation Procedures and Definitions

The Teacher–Child Interaction Direct Observation System– Research Version 2.1 (TCIDOS-RV2.1; *BEST in CLASS* Efficacy Study; see Note 2) was used for observing and coding all salient teacher and child behaviors. The TCIDOS-RV2.1 is a behavioral observation coding system designed by the authors with the distinct purpose of recording and coding responses related to implementation of the *BEST in CLASS* intervention (see Sutherland, Conroy, Vo, Abrams, & Ogston, 2013). Using a partial-interval coding system, trained observers observe and code the occurrence/ nonoccurrence of teachers' use of the *BEST in CLASS* instructional practices with focal children in the classroom and other related teacher and focal child responses that are of interest to the *BEST in CLASS* efficacy study.

Behavioral observations occurred at three time points: baseline, post-test, and maintenance (which occurred approximately 4 weeks following post-test). All observation sessions occurred during naturally occurring teacher-directed instructional time (e.g., circle, table activities) and were conducted by trained research staff in each early childhood classroom. Prior to collecting data, observers were trained on the TCIDOS-RV2.1 until they reached the criterion level of performance (i.e., recording each code correctly at a minimum of 80% across three of four videotapes). Training included reviewing and memorizing the definitions and examples of codes and completing practice coding with two separate observers on three 15-min videotapes developed for training purposes. Once observers obtained a minimum of 80% inter-observer agreement for each code across three sessions, they were given four master-coded videotapes to code and compare their codes with an expert standard. Each coder had to obtain at least 80% agreement on each code across three master-coded videotapes to become a reliable coder.

The observation sessions lasted approximately 15-min (i.e., a total of sixty, 15-s intervals). Each interval was broken down into a 10-s observation period followed by a 5-s recording period. Observers used Dell Inspiron 1090 Tablet PC installed with the Lily (Tapp, 2010) observational coding software program along with the TCIDOS-RV2.1 codes to record teacher and child behaviors during each 15-s observation interval. The Lily software, programmed with all codes from the TCIDOS-RV2.1, provided an audio cue at the end of each 10-s observation interval to indicate the beginning of the 5-s recording interval, which allowed the observer to select all the teacher and child behaviors that occurred during the observation interval. At the end of the 5-s record interval, observers were provided an auditory cue to begin the next 10-s observation period. Observers used headphones to ensure the Lily audio cue was only audible to the observer.

After an observation session, to determine the frequency of intervals during which a behavior was observed as well as inter-observer agreement, Lily files were transferred to and analyzed using Intman (Tapp, 1996; a program designed to analyze data collected with Lily software). These data were then entered into the *BEST in CLASS* REDCap database, which calculated the percentage of intervals each behavior was observed. Once the data were entered into REDcap, the data were exported into SAS and the means and standard deviations were calculated across teacher–child dyads and sites.

Definitions of the TCIDOS-RV2.1 teacher and child behavioral codes. As described above, the TCIDOS-RV2.1 was used to observe and code teachers' implementation and maintenance of the instructional practices associated with the *BEST in CLASS* intervention and corollary teacher and child responses. Teacher instructional practices included the use of rules, precorrection, opportunity to respond (OTR), behavior specific praise (BSP), instructive feedback, and corrective feedback. In addition to their use of these specific instructional practices, positive and negative teacher–child interactions were observed and coded. Finally, focal children's disruption, aggression, defiance (i.e., DAD), and engagement were also observed and coded in each condition (*BEST in CLASS* intervention and comparison). See Table 2 for definitions of teacher and child behaviors.

Inter-observer reliability estimates. Inter-observer reliability estimates were collected on 23% of the observation sessions equally across both groups by having a secondary observer collect data at the same time as the primary observer. Inter-observer reliability estimates were calculated for the occurrence or non-occurrence of the teacher and child behaviors coded represented by the total intervals coded and computed using the following formula: agreements/agreements plus disagreements × 100. Overall, inter-observer reliability estimates per code averaged between 89% and 99% (range 71.7%–100%). Percent agreement by code can be found in Table 3.

Intervention

BEST in CLASS *intervention.* All teachers in the *BEST in CLASS* intervention group received the initial 6-hr training, which was followed by 14 individualized, weekly coaching sessions. A coach spent approximately 2 hr per week in each teacher's classroom (approximately 1.5 hr providing technical assistance or conducting an observation and 30 min in a weekly coaching meeting). This time was spent implementing the four main components of the *BEST in CLASS* coaching model: (a) a collaborative weekly coaching meeting which included developing a plan for implementing the targeted *BEST in CLASS* strategy with the focal children, (b) technical assistance in the form of modeling and/or prompting on the targeted *BEST in CLASS* instructional practices each week in the context of regularly occurring teacher-directed classroom activities, (c) a focused observation that involved the coach videotaping and observing the teacher's implementation of the plan during a teacher-directed instructional activity, and (d) a reflective feedback session, which included both the coach and teacher sharing their overall impression of the success of the implementation of the practice with the focal child. During these feedback meetings, the coach shared video clips of the teacher's use of the *BEST in CLASS* practice, provided performance-based feedback (i.e., graphs depicting the percentage of intervals during which they used the strategy), and provided other anecdotal data reflecting quantity and quality.

There were a total of eight coaches who implemented coaching across the teachers. Individual coach qualifications varied; however, prior to coaching, all coaches received a coaching manual and direct training on coaching components and were checked on proficiency in the *BEST in CLASS* coaching model using an observational checklist by project staff. Only one coach had previous experience coaching. Three of the coaches held previous experience as a classroom teacher, while the remaining coaches had no classroom teaching experience. Four coaches held licensure in special education, early childhood education, or elementary education. Four coaches also held bachelor's degrees and the other four held master's degrees in a variety of disciplines, including education and psychology. At the time they began coaching, five of the eight coaches were enrolled in a PhD or master's degree, seeking programs in early childhood special education, school psychology, or counselor education.

Comparison condition. Comparison classrooms served as a business as usual condition. Teachers in comparison classrooms continued their same daily schedule, which was similar to teachers in the treatment classrooms. Instructional activities in the comparison classrooms included typical early childhood classrooms activities, such as large and small group instructional time, center-time activities, outdoor play, lunch, and snack time. Teachers in the comparison classroom participated in the same data-collection procedures as teachers in the intervention group, but they did not receive any training, training materials, or coaching in the *BEST in CLASS* intervention. Data collectors were assigned to teachers in the comparison classrooms and followed the same observation schedule used in the treatment condition.

Table 2. Definitions of Teacher and Child Behaviors.

Code	Definition
Teacher behavior	
Rules	A teacher issued verbal statement that contains the word "rule" and is directed at the focal child or focal child group.
Precorrection	A teacher issued verbal statement that reminds the focal child or focal child group of expectations prior to entering a situation (activity/transition) to prevent predictable problem behaviors or errors.
Opportunity to respond	A teacher issued instructional question, request, command, or gesture that seeks a response from the focal child or focal child group.
Behavior specific praise	A teacher issued verbal statement directed at the focal child or focal child group that (a) indicates approval of a behavior or correct response over and above an evaluation of adequacy, and (b) specifies the behavior being praised.
Instructive feedback	A teacher issued verbal statement to the focal child, focal child group, or member of the focal child group that (a) acknowledges a correct response or appropriate behavior, and (b) provides additional instructional information.
Corrective feedback	A teacher issued verbal statement to the focal child, focal child group, or member of the focal child group that acknowledges an (a) incorrect response, or (b) display of incorrect information, or (c) inappropriate behavior, and provides information for a correct alternative behavior or response.
Child behaviors	
Disruption, aggression, defiance	Focal child demonstrates one of the following behaviors:
	Disruption is defined as a verbalization, physical act, or gesture that either interrupts or has the potential to interrupt classroom instruction.
	Aggression is defined as a behavior aimed at causing harm, pain, or personal injury (verbal or physical).
	Defiance is defined as a behavior that is challenging, non-compliant, confrontational, openly and boldly challenging, and resisting authority.
Engagement	Focal child is participating appropriately and/or working on an assigned/approved activity.
Interaction codes	
Positive interaction	The teacher and the focal child are engaged in an exchange in which both parties are exhibiting positive/neutral behavior and/or affect.
Negative interaction	Teacher and focal child are engaged in an exchange in which one or both parties are exhibiting negative behavior and/or affect.

Table 3. Inter-Observer Reliability Estimates.

Teacher and child behaviors	M	Range
Rule	98.55	92.5–100
Precorrection	99.04	92.9–100
Opportunities to respond	89.01	89.2–100
Behavior specific praise	99.06	92.5–100
Instructive feedback	97.07	85.0–100
Corrective feedback	97.99	92.5–100
Disruption/aggression/defiance	96.70	76.7–100
Engagement	93.92	75.0–100
Positive interaction	94.66	71.7–100
Negative interaction	95.99	78.3–100

Design and Analysis

Our research questions imply a comparison of the *BEST in CLASS* and comparison group teachers at the post-test and maintenance time points (effect of specific instruction and practice-based coaching) and comparisons of *BEST in CLASS* teachers at the baseline and post-test time points and at the baseline and maintenance time points. To address these questions, we used PROC MIXED in SAS 9.3 to conduct multilevel analysis and carry out planned comparisons of the means for the *BEST in CLASS* group and comparison group at the post-test and maintenance time points. In addition, planned comparisons were conducted to compare means for the *BEST in CLASS* group at the baseline and post-intervention time points and at the baseline and maintenance time points.

Teachers volunteered to participate in the current study and were randomized within schools at each research site. Analyses conducted at baseline indicated no significant differences in the level of education and teaching experience based on group assignment (*BEST in CLASS* vs. comparison). To minimize cross classroom contamination, the teachers in the *BEST in CLASS* condition were instructed not to share any information about the *BEST in CLASS* intervention with comparison teachers in their schools. All teachers in the treatment condition agreed to follow these instructions. In addition, to examine potential research site differences, analyses examining Time × Group × Site interactions

Table 4. Baseline and Post-Intervention Means and Standard Deviation Within *BEST in CLASS* and *t*-Test Results.

| | *BEST in CLASS* intervention (N = 60) | | Condition effect | | |
| | Baseline | Post-intervention | | | |
Teacher and child behaviors	M (SD)	M (SD)	df	t	p value
Teacher behaviors					
Rules	0.02 (0.04)	0.11 (0.09)	25.89	8.47	0.00
BSP	0.01 (0.03)	0.07 (0.05)	22.39	6.52	0.00
OTR	0.41 (0.18)	0.54 (0.19)	27.22	2.82	0.01
PC	0.01 (0.02)	0.07 (0.07)	34.82	7.68	0.00
IF	0.01 (0.02)	0.11 (0.01)	26.95	7.03	0.00
CF	0.01 (0.02)	0.05 (0.04)	28.06	7.79	0.00
Child behaviors					
Engagement	0.87 (.12)	0.98 (.03)	112.7	6.07	0.00
Disruption	0.10 (.12)	0.01 (.03)	116.5	−5.75	0.00
Interactions					
Positive	0.87 (0.14)	0.98 (0.03)	123.70	6.02	0.00
Negative	0.10 (0.10)	0.01 (0.04)	33.94	−4.66	0.00

Note. BSP = behavior specific praise; OTR = opportunities to respond; PC = precorrection; IF = instructive feedback; CF = corrective feedback.

were conducted. The interaction was non-significant for each variable, indicating that it was appropriate to collapse over site to test treatment effects at post-test and maintenance and time comparisons for the *BEST in CLASS* group. Due to child attrition and absences, 60 teacher/child pairs were observed in the *BEST in CLASS* treatment condition and 47 in the comparison condition at post-test, and 59 pairs were observed in the *BEST in CLASS* treatment condition and 48 in the comparison condition at maintenance.

PROC Mixed in SAS 9.3 was used to estimate model parameters and conduct planned comparisons of means. Random effects in the model were schools (level-3), teachers within schools (level-2), and children with teachers within schools (level-1). The fixed effect features of the model was a two site × (Treatment) × three (Time) design one, with repeated measures on the time factor. The levels of the treatment factor were *BEST in CLASS* and comparison. The levels of the time factor were the baseline, post-intervention, and maintenance time points. In an initial model, correlated child random effects for the three time points were specified, resulting in different variance components for children at each time point and different covariance components for children for each pair of time points. The same model feature was adopted for teacher and school random effects. When the estimation procedure for the initial model did not converge, the covariance structure was specified to have equal variance components at the three time points and equal covariance components for the three pairs of time points at both the teacher and school levels (Structure 2) or at the school level (Structure 3). Estimation of the original covariance structure converged for behavior specific praise, opportunities to respond, precorrection,

instructive feedback, and negative interactions. For rules, engagement, disruptive, and positive interaction covariance Structure 2 converged and for corrective feedback covariance Structure 3 converged.

Results

As seen in Tables 4 and 5, the results indicated that the teachers who received the *BEST in CLASS* intervention significantly increased the overall percentage of intervals from baseline to post-test and from baseline to maintenance of their use of rules, precorrection, behavior specific praise, instructive feedback, and corrective feedback. The overall percentage of opportunities to respond also significantly increased from baseline to post-test; however, between baseline and maintenance, no significant difference was found. In addition to teacher behaviors, significant increases were found on child behaviors across these time points. The overall percentage of child engagement significantly increased for the intervention group from baseline to post-test and from baseline to maintenance. In addition, the overall percentage of disruptive, aggressive, defiant behavior significantly decreased for the intervention group from baseline to post-test and baseline to maintenance. Similarly, the overall percentage of positive interactions significantly increased and negative interactions significantly decreased for the intervention group from baseline to post-test and maintenance.

As seen in Tables 6 and 7, the results indicated that the teachers who received the *BEST in CLASS* intervention significantly increased the overall percentage of intervals from baseline to post-intervention and from baseline to

Table 5. Baseline and Maintenance Means and Standard Deviation Within *BEST in CLASS* and *t*-Test Results.

| Teacher and child behaviors | BEST in CLASS intervention (N = 59) | | Condition effect | | |
| | Baseline | Maintenance | | | |
	M (SD)	M (SD)	df	t	p value
Teacher behaviors					
Rules	0.02 (0.04)	0.11 (0.11)	37.07	7.36	0.00
BSP	0.01 (0.03)	0.05 (0.05)	22.36	4.01	0.00
OTR	0.41 (0.18)	0.49 (0.18)	19.03	1.59	0.13
PC	0.01 (0.02)	0.06 (0.07)	32.39	5.38	0.00
IF	0.01 (0.02)	0.08 (0.07)	35.73	7.42	0.00
CF	0.01 (0.02)	0.04 (0.04)	34.84	5.72	0.00
Child behaviors					
Engagement	0.87 (0.12)	0.96 (0.05)	107.2	4.15	0.00
Disruption	0.10 (0.12)	0.02 (0.05)	117.3	−4.16	0.00
Interactions					
Positive	0.87 (0.14)	0.96 (0.05)	118.70	4.34	0.00
Negative	0.10 (0.10)	0.02 (0.05)	26.04	−2.66	0.01

Note. BSP = behavior specific praise; OTR = opportunities to respond; PC = precorrection; IF = instructive feedback; CF = corrective feedback.

Table 6. Baseline and Post-Intervention Means and Standard Deviation Between Condition and *t*-Test Results.

| Teacher and child behaviors | BEST in CLASS intervention (N = 60) | | Control (N = 47) | | Condition effect | | |
| | Baseline | Post-intervention | Baseline | Post-intervention | | | |
	M (SD)	M (SD)	M (SD)	M (SD)	df	t	p value
Teacher behaviors							
Rules	0.02 (0.04)	0.11 (0.09)	0.02(0.04)	0.01 (0.02)	33.01	6.96	0.00
BSP	0.01 (0.03)	0.07 (0.05)	0.01 (0.02)	0.00 (0.01)	29.24	9.03	0.00
OTR	0.41 (0.18)	0.54 (0.19)	0.39 (0.20)	0.33 (0.14)	45.69	5.38	0.00
PC	0.01 (0.02)	0.07 (0.07)	0.01 (0.02)	0.01 (0.02)	31.52	5.80	0.00
IF	0.01 (0.02)	0.11 (0.10)	0.01 (0.02)	0.01 (0.03)	26.65	5.38	0.00
CF	0.01 (0.02)	0.05 (0.04)	0.01 (0.01)	0.01 (0.01)	95.94	7.55	0.00
Child behaviors							
Engagement	0.87 (0.12)	0.98 (0.03)	0.86 (0.15)	0.91 (0.09)	53.36	5.55	0.00
Disruption	0.10 (0.12)	0.01 (0.03)	0.08 (0.16)	0.07 (0.11)	29.32	−5.21	0.00
Interactions							
Positive	0.87 (0.14)	0.98 (0.03)	0.86 (0.17)	0.92 (0.09)	30.31	5.53	0.00
Negative	0.10 (0.10)	0.01 (0.04)	0.12 (0.16)	0.08 (0.11)	21.22	−5.51	0.00

Note. BSP = behavior specific praise; OTR = opportunities to respond; PC = precorrection; IF = instructive feedback; CF = corrective feedback.

maintenance of their use of rules, precorrection, opportunities to respond, behavior specific praise, instructive feedback, and corrective feedback in comparison with teachers who did not receive the intervention. In addition, the overall percentage of child engagement significantly increased for the intervention group from baseline to post-test and maintenance in comparison with the control group at baseline, post-test, and maintenance. The overall percentage of disruptive, aggressive,

defiant behavior significantly decreased for the intervention group from baseline to post-test, and maintenance in comparison with the control group at baseline, post-test, and maintenance. Similarly, the overall percentage of positive interactions significantly increased and negative interactions significantly decreased for the intervention group from baseline to post-test and maintenance in comparison with the control group at baseline, post-test, and maintenance.

Table 7. Baseline and Maintenance Means and Standard Deviation Between Condition and *t*-Test Results.

| Teacher and child behaviors | BEST in CLASS intervention (N = 59) | | Control (N= 48) | | Condition effect | | |
| | Baseline | Maintenance | Baseline | Maintenance | | | |
	M (SD)	M (SD)	M (SD)	M (SD)	df	t	p value
Teacher behaviors							
Rules	0.02 (0.04)	0.11 (0.11)	0.02(0.04)	0.01 (0.03)	45.57	5.48	0.00
BSP	0.01 (0.03)	0.05 (0.05)	0.01 (0.02)	0.00 (0.01)	29.06	5.45	0.00
OTR	0.41 (0.18)	0.49 (0.18)	0.39 (0.20)	0.33 (0.17)	37.96	4.27	0.00
PC	0.01 (0.02)	0.06 (0.07)	0.01 (0.02)	0.01 (0.02)	29.47	4.95	0.00
IF	0.01 (0.02)	0.08 (0.07)	0.01 (0.02)	0.02 (0.03)	30.75	5.52	0.00
CF	0.01 (0.02)	0.04 (0.04)	0.01 (0.01)	0.01 (0.01)	101.2	5.03	0.00
Child behaviors							
Engagement	0.87 (0.12)	0.96 (0.05)	0.86 (0.15)	0.89 (0.15)	101.4	3.77	0.00
Disruption	0.10 (0.12)	0.02 (0.05)	0.08 (0.16)	0.09 (0.16)	92.1	−3.40	0.00
Interactions							
Positive	0.87 (0.14)	0.96 (0.05)	0.86 (0.17)	0.89 (0.15)	92.35	3.71	0.00
Negative	0.10 (0.10)	0.02 (0.05)	0.12 (0.16)	0.08 (0.16)	19.6	−2.26	0.04

Note. BSP = behavior specific praise; OTR = opportunities to respond; PC = precorrection; IF = instructive feedback; CF = corrective feedback.

Discussion

Findings from the current study contribute to a growing body of literature in the areas of effective professional development strategies and instructional practices and implementation science. In summary, this investigation suggests that when provided with specific instruction and practice-based coaching over time, early childhood teachers increased and maintained their use of effective instructional practices with children who were at elevated risk for the development of EBD and school failure. One exception was that the teachers' increased use of opportunities to respond did not significantly increase from baseline to maintenance. Although unfortunate, the finding may not be deleterious, given the relatively high levels of OTR at baseline and maintenance in comparison with teachers' use of other effective strategies. In addition, when teachers increased their use of effective instructional practices, teacher–child interactions and focal children's social and behavioral outcomes improve. These findings are noteworthy for several reasons.

First, the positive changes in teacher behavior and corollary child behavior changes in the intervention group in comparison with the control group are encouraging. Nationally, there is an increase in the prevalence rates of young children who demonstrate chronic problem behaviors in early childhood programs (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Carter et al., 2010; Hamre & Pianta, 2001). As discussed earlier, due to the severity and intensity of these behaviors, their outcomes can be quite dismal. Many of these children are at elevated risk for negative interactions between themselves and their teachers (Driscoll & Pianta, 2010; Quesenberry, Hemmeter,

& Ostrosky, 2011) and being suspended and expelled from their early childhood programs (Gilliam & Shahar, 2006). As they enter school, they often experience further difficulties, including continued negative interactions with their teachers, poor academic outcomes, peer rejection, and identification of EBDs (Dunlap et al., 2006; Marchant, Young, & West, 2004; Nelson, Stage, Duppong-Hurley, Synhorst, & Epstein, 2007). At the same time, many early childhood teachers report they are underprepared in the area of managing problem behavior and express a need for professional development in learning how to effectively address these young children's behavior challenges (Hemmeter, Corso, & Cheatham, 2006). Early prevention/intervention programs that are effective in teaching teachers how to intervene on the problem behaviors of these young children prior to entering school are critically needed. The data presented in the current investigation provides additional evidence using a more rigorous experimental design suggesting that *BEST in CLASS* is one intervention that includes an effective professional development model that supports and enhances teachers' use of evidence-based instructional practices, and that teachers' increased use of these practices results in improved behavioral outcomes for young children at elevated risk for EBD.

Of note an important focus of the *BEST in CLASS* professional development model is the practice-based coaching component. Because research suggests that professional development in the form of one-time training does not result in proficient delivery of practices in authentic settings (Becker & Domitrovich, 2011; Sholomskas et al., 2005), the practice-based coaching model included in *BEST in CLASS* may be particularly important in affecting and

maintaining the teacher behavior changes reported in this article. This model is supported by a large literature that suggests that coaching strategies such as collaborative decision making, modeling, observation and performance feedback, and opportunities to problem solve enhance and sustain teacher delivery of intervention components (Reinke, Sprick, & Knight, 2009; Reyes, Brackett, Rivers, White, & Salovey, 2012). Furthermore, *BEST in CLASS*, and in particular the practice-based coaching model, would appear to have significant applications within the implementation science framework.

To illustrate, implementation science has been defined as "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practices" (Eccles & Mittman, 2006, p. 1). Results of this study suggest that *BEST in CLASS* is a promising method to promote teachers' use of evidence-based practices within authentic classroom contexts, and maintenance data suggest that teachers' use of the practices continued 1 month after the coaching ceased, although with slight decreases. While a first step in the examination of the implementation of *BEST in CLASS*, future work within an implementation science framework should involve examining the maintenance of teacher effects farther into the future (e.g., 6 months) as well as training school personnel to implement the coaching model.

Although the findings reported in this article are promising, there are several limitations that should be noted. First, the TCIDOS-RV 2.1 observation and coding system has several limitations. The TCIDOS-RV 2.1 is a researcher developed partial-interval behavioral observation system, which only provides an estimate of the occurrence of each code. It is possible that teacher and child behaviors may be over or under reported. In addition, the TCIDOS-RV 2.1 has not been validated and does not include a measure of the quality of the responses. Although behavioral definitions were developed to include quality aspects of the responses, it is likely that teachers' behaviors may have varied in quality. While the quality of teacher delivery of *BEST in CLASS* practices is assessed using the *BEST in CLASS* Adherence and Competence Scale (Sutherland, McLeod, Conroy, Abrams, & Smith, 2013), this assessment tool provides an estimate of quality across an observation using a rating scale rather than a quality rating associated with the specific intervals of the TCIDOS-RV 2.1. Finally, observers were not blinded to condition and teacher and child reactivity to observer presence may have influenced the occurrence of behaviors. However, procedures were in place to attempt to mitigate these limitations by monitoring observers' reliability and acclimating teachers and children to observer presence prior to data collection.

Several other limitations also apply to the current study. First, all participating teachers in the study were females. Therefore, the generalizability of findings to male teachers is unknown. In addition, the *BEST in CLASS* intervention uses an expert coaching model, which includes a comprehensive data-collection system. This type of model and data collection can be costly and time-intensive, making widespread implementation of this model difficult across a variety of early childhood settings. To address these limitations, further research expanding the characteristics of the participants and refinement of the coaching model (e.g., peer or self coaching) should be conducted.

In conclusion, data from this study suggest that *BEST in CLASS* had a positive effect on teachers' delivery of the instructional practices associated with the intervention model, effects that were evident 1 month after the intervention ended, teacher–child interactions improved, and focal children's classroom outcomes improved. While research is ongoing on the efficacy of this model, including standardized data from multiple sources across both individual child and classroom level variables, these preliminary data are encouraging. As researchers attempt to identify interventions that have the potential to affect child outcomes within an implementation science framework, programs such as *BEST in CLASS* provide promise for use in authentic classroom settings.

Authors' Note

Declaration of Conflicting Interests

Funding

Notes

1. Contact the first author for further information on the *BEST in CLASS* intervention.
2. A copy of the *BEST in CLASS* research manuals and materials are available on request from the first author.
3. A copy of the TCIDOS-RV2.1 is available on request from the first author.

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