A Course on Effective Teacher-Child Interactions: Effects on Teacher Beliefs, Knowledge, and Observed Practice

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Abstract:

Among 440 early childhood teachers, half were randomly assigned to take a 14-week course on effective teacher-child interactions. This course used the Classroom Assessment Scoring System (CLASS) as the basis to organize, describe, and demonstrate effective teacher-child interactions. Compared to teachers in a control condition, those exposed to the course reported more intentional teaching beliefs and demonstrated greater knowledge of and skills in detecting effective interactions. Furthermore, teachers who took the course were observed to demonstrate more effective emotional and instructional interactions. The course was equally effective across teachers with less than an associate's degree as well as those with advanced degrees. Results have implications for efforts to improve the quality of early childhood programs through the higher education system.

Keywords: early childhood education | professional development | teacher-child interactions | randomized-control trial | coursework

Article:

Despite substantial investments, the promise of early childhood education in the United States is not being realized—poor children continue to enter kindergarten far behind their more well-off peers (Jacobson-Chernoff, Flanagan, McPhee, & Park, 2007;Johnson, 2002; National Center for Education Statistics [NCES], 2000). Although there are many reasons, recent evidence suggests that the mediocre quality of teacher-child interactions within early childhood settings plays a significant role, particularly in relation to children's development of literacy and language skills (Dickinson & Brady, 2006; Howes et al., 2008; Jackson et al., 2006; Mashburn et al., 2008).

Teacher-child interactions are the daily back-and-forth exchanges that teachers and children have with one another throughout each day, including those that are social and instructional in nature. Given the clear need for interventions that enhance the effectiveness of early childhood educational offerings in the United States (Moorehouse, Webb, Wolf, & Knitzer, 2008), how to most effectively and efficiently improve the quality and potential impact of teachers' daily interactions with children is a key focus for research.

The National Center for Research on Early Childhood Education (NCRECE) is engaged in a program of research on professional development for early childhood educators that tests the efficacy of two specific approaches to increasing teachers' effective use of social and instructional interactions. These interventions include: (a) a semester-long course for teachers focused on high-quality interactions with children and (b) an approach to coaching in which teachers receive regular and focused feedback and support to improve their interactions with children, based on shared observation and analysis of their own teaching practice. Both interventions focused explicitly on enhancing teacher-child interactions to foster children's language and literacy development. The study design randomizes teachers into one of four conditions: 1-no course/no consultancy, 2-no course/consultancy, 3-course/no consultancy, and 4-course/consultancy.

The current article reports results pertaining to the first phase of the study—the impacts of a course for early childhood teachers designed to enhance their use of effective teacher-child interactions. The study assesses the degree to which teachers who were randomly assigned to take a 14-week course differed from their peers who did not take the course in terms of their beliefs and knowledge about effective practices and interactions and the independently observed quality of their interactions with children in their classrooms. In the following, we discuss the conceptualization and rationale for this work.

Need for Professional Development Targeting Effective Teacher-Child Interactions

Several factors contribute to a growing interest in targeting interventions toward improvements in the quality of teachers' interactions with children. First, there is now compelling empirical evidence that one of the most salient aspects of early childhood programs' effects on children's development is the nature and quality of teachers' interactions with children (Brophy-Herb, Lee, Nievar, & Stollak, 2007; Curby et al., 2009; Dickinson & Brady, 2006; Guo, Piasta, Justice, & Kaderavek, 2010; Howes et al., 2008; Jackson et al., 2006; Mashburn et al., 2008; McCartney, Dearing, Taylor, & Bub, 2007; Pianta, Barnett, Burchinal, & Thornburg, 2009). Second, national data suggest that the average pre-k child is likely to experience teacher-child interactions of mediocre to low quality (Phillips, Gormley, & Lowenstein, 2009; Pianta et al., 2005). One particular area for concern is teachers' use of effective interactions during the delivery of literacy and language instruction. Early childhood teachers rarely use effective strategies for explicitly teaching early literacy and language skills (Cunningham, Zibulsky, & Callahan, 2009; Hindman & Wasik, 2008; Justice, Mashburn, Hamre, & Pianta, 2008), despite evidence that these practices

are essential for children at risk of school failure (Farver, Lonigan, & Eppe, 2009;Girolametto & Weitzman, 2002; Hamre, Justice, et al., 2010).

One final factor promoting interest in interventions targeting improvements in teacher-child interactions is the inclusion of measures of teacher-child interactions in monitoring and quality improvement policies. For example, the Office of Head Start has adopted the Classroom Assessment Scoring System (CLASS; Pianta, LaParo, & Hamre, 2007) as a part of its triennial monitoring process, focusing on three broad domains of interaction—Emotional Support, Classroom Organization, and Instructional Support. Thus, every Head Start grantee across the country will be reviewed based in part on the quality of interactions observed within their classrooms. Several states are also including the CLASS or other measures of teacher-child interactions as one component of their Quality Rating and Improvement Systems (Tout et al., 2010) or other improvement efforts. Thus, not only is there strong conceptual and empirical justification for the value of teacher-child interactions for promoting young children's development, but in addition, the current policy context of accountability is pushing early childhood programs toward a focus on the interactions teachers have with children.

Defining Effective Teacher-Child Interactions

Hamre and Pianta (2007) described three broad domains of teacher-child interaction that are hypothesized to facilitate children's developmental progress as a result of their experiences in classrooms (Emotional Support, Classroom Organization, and Instructional Support), including dimensions of teacher-child interaction that operate specifically on children's literacy and language development (see Table 1). This conceptualization of the nature and form of everyday interactions between teachers and children in classrooms is based on an accumulation of theory and empirical evidence about the specific types of classroom interactions that are most effective for promoting children's social and academic development. Importantly for the purposes of this work, there is evidence to suggest that each domain of interactions has either direct or indirect effects on children's language and literacy development (Downer, Sabol, & Hamre, 2010).

Table 1 Classroom Assessment Scoring System (CLASS) Framework for Early Childhood and Elementary Classroom Quality

Domain	**Dimension**	**Description**
Emotional Support	Positive climate	Reflects the overall emotional tone of the classroom and the connection between teachers and students. Considers the warmth and respect displayed in teachers' and students' interactions with one another as well as the degree to which they display enjoyment and enthusiasm during learning activities
	Negative climate	Reflects the overall level of expressed negativity in the classroom. The frequency, quality, and intensity of teacher and peer negativity are key to this scale.

	Teacher sensitivity	Encompasses teachers' responsivity to students' needs and awareness of students' level of academic and emotional functioning. The highly sensitive teacher helps students see adults as a resource and creates an environment in which students feel safe and free to explore and learn.
	Regard for student perspectives	The degree to which the teacher's interactions with students and classroom activities place an emphasis on students' interests, motivations, and points of view, rather than being very teacher-driven. This may be demonstrated by teachers' flexibility within activities and respect for students' autonomy to participate in and initiate activities.
Classroom Organization	Behavior management	Encompasses teachers' ability to use effective methods to prevent and redirect misbehavior by presenting clear behavioral expectations and minimizing time spent on behavioral issues.
	Productivity	Considers how well teachers manage instructional time and routines so that students have the maximum number of opportunities to learn. Not related to the quality of instruction, but rather teachers' efficiency.
	Instructional learning formats	The degree to which teachers maximize students' engagement and ability to learn by providing interesting activities, instruction, centers, and materials. Considers the manner in which the teacher facilitates activities so that students have opportunities to experience, perceive, explore, and utilize materials.
Instructional Support	Concept development	The degree to which instructional discussions and activities promote students' higher-order thinking skills versus focus on rote and fact-based learning.
	Quality of feedback	Considers teachers' provision of feedback focused on expanding learning and understanding (formative evaluation), not correctness or the end product (summative evaluation).
	Language modeling	The quality and amount of teachers' use of language-stimulation and language-facilitation techniques during individual, small group, and large group interactions with children. Components of high-quality language modeling include self and parallel talk, open-ended questions, repetition, expansion/extension, and use of advanced language.
	Literacy focus[a]	Reflects the quality with which teachers deliver activities focusing children on ''code units'' of early literacy (e.g., letters, words, phonemes).

[a]Literacy focus is not a part of the published version of CLASS, but is available from authors upon request for those who have attended CLASS training.

Within the social and emotional domain, the positive effects of exposure to warm, sensitive caregiving in child care and preschool settings are well documented (McCartney et al., 2007; McDonald-Connor, Son, Hindman, & Morrison, 2005), while children exposed to more

child-focused and autonomy supportive instruction report more positive feelings about school, display more motivation, and are more engaged in classroom activities (de Kruif, McWilliam, Ridley, & Wakely, 2000; Gutman & Sulzby, 2000; Pianta, LaParo, Payne, Cox, & Bradley, 2002; Valeski & Stipek, 2001). In contrast, children in more teacher-directed classrooms have higher levels of maternal-reported internalizing problems (NICHD Early Child Care Research Network, 2003).

With regard to organizationally supportive interactions, more positive student behavior is associated with the provision of consistent behavioral expectations and proactive use of monitoring and behavioral/emotional supports (Emmer & Stough, 2001) and teachers' efficient use of time. Children learn more when they are more consistently exposed to instructionally rich activities; this is important given that the average preschool child spends about 44% of their time in noninstructional activities, such as waiting in line to wash hands or eating (Early et al., 2010).

Finally, teachers' provision of cognitively stimulating opportunities to learn and feedback about learning are key elements of instructional support derived from research on children's cognitive and language development (e.g., Catts, Fey, Zhang, & Tomblin, 2001; Fujiki, Brinton, & Clarke, 2002; Romberg, Carpenter, & Dremock, 2005; Taylor, Pearson, Peterson, & Rodriguez, 2003; Vygotsky, 1991; Wharton-McDonald & Pressley, 1998). This domain of teacher-child interactions appears to be most closely linked to young children's development of early literacy and math skills (Burchinal et al., 2008; Guo et al., 2010; Mashburn et al., 2008).

In addition to these broad domains of effective teacher-child interactions, a specific set of content-related interactions appears to foster children's language and early literacy development. For example, the use of open-ended questions, expansions, advanced linguistic models, and recasts are associated with positive language achievements in young children (e.g., Baker & Nelson, 1984; Vasilyeva, Huttenlocher, & Waterfall, 2006; Wasik, Bond, & Hindman, 2006; Yoder, Spruytenburg, Edwards, & Davies, 1995). High-quality literacy instruction in the preschool classroom is characterized by instruction that explicitly teaches children the code-based characteristics of written language, including both phonological and print structures (Justice et al., 2008). Although this instruction may be embedded purposefully within contextualized routines and activities (e.g., dramatic play, arts and crafts, writing), it frequently features a relatively teacher-directed orientation so as to ensure systematicity and explicitness (Byrne & Fielding-Barnsley, 2000; Justice, Chow, Capellini, Flanigan, & Colton, 2003; van Kleeck, Gillam, & McFadden, 1998). Intervention studies indicate that children's exposure to systematic and organized approaches to literacy-promoting interactions can accelerate skill development (e.g., Hamre, Justice, et al., 2010; Justice et al., 2003; van Kleeck et al., 1998).

Approaches to Encouraging More Effective Teacher-Child Interactions

There is not much evidence that the typical professional development opportunities in which teachers engage (e.g., courses, workshops) produce improvements or sustained changes in the

types of teacher-child interactions described previously. In fact, a considerable point of contention for many years has been whether or not a bachelor's degree should be a minimal requirement for teaching in an early childhood classroom. The failure to find systematic associations between degree status and program quality or child outcomes suggests that simply requiring a bachelor's degree will not guarantee positive outcomes for children in early childhood programs (Early et al., 2007). However, recent work suggests professional development that directly targets improvements in teacher-child interactions can be effective (Bierman, Nix, Greenberg, Blair, & Domitrovich, 2008; Domitrovich et al., 2008; Hsieh, Hemmeter, McCollum, & Ostrosky, 2009; Pianta, Mashburn, Downer, Hamre, & Justice, 2008;Ramey & Ramey, 2008; Raver et al., 2008). Most of these newer, empirically supported approaches to professional development provide some combination of curriculum training and classroom-based coaching to teachers (Bierman et al., 2008;Domitrovich et al., 2008; Hsieh et al., 2009; Pianta et al., 2008; Raver et al., 2008). There is less evidence on the degree to which these interventions could be the focus of more formal coursework that would ultimately contribute to degree-related requirements that do produce more effective teaching.

Few studies have systematically tested the effects of courses on early childhood teacher-child interactions or child outcomes (see Dickinson & Caswell, 2007; Howes, Galinsky, & Kontos, 1998; Kontos, Howes, & Galinsky, 1996; Neuman & Cunningham, 2009, for exceptions), despite the assumption that exposure to teacher preparation courses or accumulation of course credits leads to more effective teaching. Here we use the word *course* to refer to a unit of teaching that typically lasts one academic term, is led by an instructor, has a fixed roster of students, and includes formal evaluation (e.g., grades, exams, projects). Thus, courses are different from the typical workshops delivered during in-service training. However, courses can be delivered as a part of either pre-service or in-service training and have the potential to be scaled through the higher education system in ways that are unlikely to occur in the context of curricular or coaching-based interventions (Scott-Little et al., in press).

Although there are a few other examples of effects of courses on early childhood practice, the current study offers a unique contribution in a number of ways. First, courses often focus either on social-emotional teaching practices (e.g., Howes et al., 1998) or instructional practices (e.g., Dickinson & Caswell, 2007). In this study we examine the ability to change both social and instructional teaching interactions within the context of a 14-week course. Second, there are few examples in which teachers have been randomly assigned to a course (see Dickinson & Caswell, 2007, for exception), and there is a need for further documentation of effects on coursework using this more rigorous experimental design. Third, this study was conducted among a very large and diverse population of teachers in 10 sites across the country. Teachers in the study had widely varying levels of education and experience. Thus, findings of this study can be generalized to a larger population of teachers than previous studies conducted with smaller, more homogenous samples of teachers. One final way in which this study is different from previous research is that it explicitly tests a theory of change in which changes in belief and knowledge

are anticipated to mediate effects on practice. This theory of change is discussed in the following.

Theory of Change: Beliefs, Knowledge, and Skills Related to Effective Interactions

In their review of research on professional development in early childhood, Sheridan and colleagues (Sheridan, Edwards, Marcin, & Knoche, 2009) suggest that professional development studies be designed to understand the "dynamic and transactional teacher and learning processes underlying effects." Key to this aim is a theory of change that articulates the proximal targets of an intervention, which in turn should be linked to child learning gains in a particular domain. In prior work on a coaching intervention, we describe this as a process of aligning professional development inputs to teachers with the behaviors in the classroom that advance children's learning (Pianta, Hamre, & Downer, 2011).

Figure 1 presents the theory of change model that guided the development of the NCRECE course—one designed to improve teacher-child interactions linked to children's language and literacy performance. One goal of this course was to help teachers understand that all interactions, whether social, organization, or instructional, serve as a foundation for early language and literacy development. For example, although emotional support is linked most closely to social development, there is also evidence that emotionally supportive teaching and positive teacher-student relationships are either directly or indirectly related to children's early academic development (Downer et al., 2010). Therefore, as described in greater detail in the method section, the first units of the course focused on these more generalized, foundational interactions but also explicitly brought teachers' attention to the relevance of these interactions for children's development of language or literacy skills.

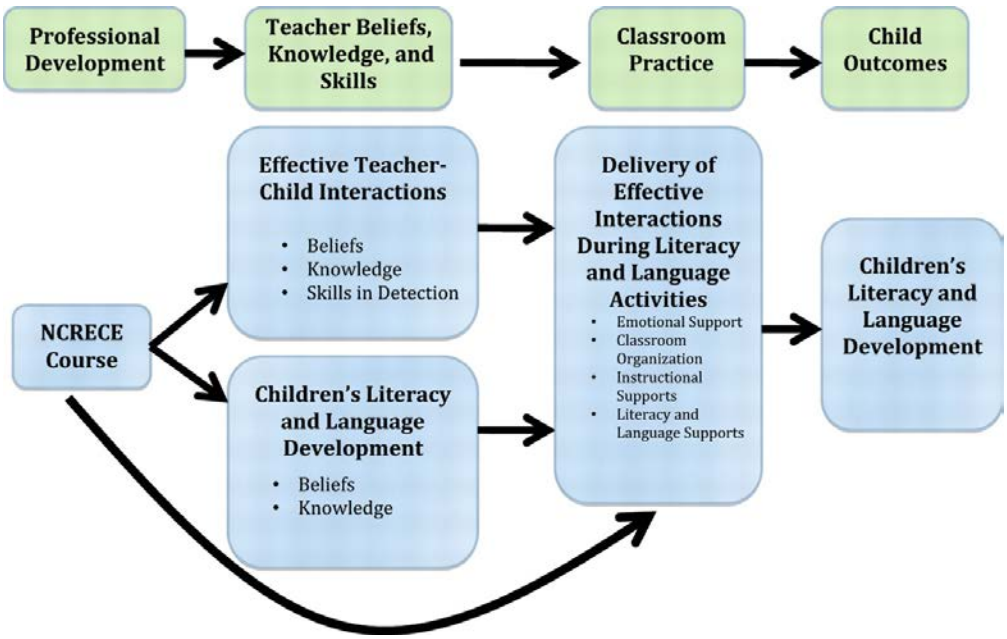

Figure 1. Theory of change model for coursework on effective teacher-child interactions. *Note*. NCRECE = National Center for Research on Early Childhood Education.

A second goal was to provide teachers with knowledge about and examples of instructional interactions and activities that are focused *directly* on enhancing children's development of language and literacy skills. The latter sections of the course taught teachers about the major areas of language and literacy development and provided them with examples of classroom activities intended to target these skills. Here again an attempt was made to help teachers see that intentional use of instructionally supportive interactions can facilitate children's learning of language and literacy content. For example, we demonstrated how evidence-based literacy lessons were much more effective when infused with rich, back-and-forth feedback loops with children.

The theory posits two potential pathways for changing these interactions. In one pathway, the course promotes teacher learning in two domains of belief, knowledge, and skill that hypothetically mediate change in classroom behavior—one domain focused on generalized teacher-child interactions and the other on specific instructional strategies for developing literacy and language skills. We also posit a direct pathway in which teachers imitate effective behaviors viewed in course videos. As suggested by social learning theory (Bandura, 1986), teachers may learn how to behave in large part through observation of others. Dynamic memory theory (Schank, 1982) extends this work by suggesting that the schemas and scripts that people develop based on watching others are an important component of learning how to behave in a particular moment. This work suggests that teachers should learn a lot about how to teach from watching examples of teaching—an idea that has been validated by work on "teacher noticing" (e.g., Van Es & Sherin, 2002). In contrast to the mediated pathway, this direct pathway suggests that teacher knowledge, belief, and skills in the aforementioned domains may be inconsequential to changes in practice or may come after teachers make changes to practice.

The literature connecting beliefs to practices has led to varying conclusions about the centrality of beliefs in leading to behavioral change (e.g., Pajares, 1992; Sigel & McGillicuddy-De Lisi, 2002). However, there are a number of studies in early childhood that provide evidence that teacher beliefs may be an important target for interventions that ultimately aim to change teacher behavior (LaParo et al., 2009; McMullen et al., 2005; Pianta et al., 2005; Spear-Swerling & Brucker, 2004; Stipek & Byler, 1997).

With regard to beliefs about teacher-child interactions, the course was designed to advance the belief that teachers need to be actively engaged in interactions with children in order for learning to occur. Teachers who believe they should take a more passive role in children's learning are unlikely to engage in intentional teacher-child interactions, particularly instruction. Although definitions of "developmentally appropriate practice" suggest the importance of active involvement (National Association for the Education of Young Children, 2009), many early childhood professionals assert beliefs that downplay the active role of adults in children's

learning. Thus, the course materials provided examples from research and video highlighting how cognitive and language development was enhanced through intentional teacher-child interactions.

The course also provided very specific knowledge about effective interactions and used the CLASS (Pianta et al., 2008), a validated observational measure, as the framework for this knowledge. Teachers were taught to make explicit links between teachers' behavioral actions and intended consequences for children. For example, when learning about behavior management, teachers were encouraged to watch and analyze videos that highlighted the ways in which specific teacher actions led to more or less positive behaviors among students in the classrooms. The course also targeted teachers' skills in *detecting* effective teacher-child interactions though video analysis. We hypothesized that it was not sufficient for teachers to be able to gain knowledge*about* effective interactions; they needed *actual skills* involving identification of effective interactions with a high degree of specificity in order to be most likely to transfer the coursework into changes in their practice.

The second domain of belief, knowledge, and skill targeted in the course concerned children's literacy and language skills. For example, teachers must know that young children who gain pre-literacy and early language skills during the preschool year are much more likely to be successful in kindergarten. And although early childhood teachers tend to endorse the importance of systematically and intentionally developing children's language skills, they tend to not endorse active teaching of early literacy (Hindman & Wasik, 2008). Importantly, these beliefs are amenable to intervention (e.g., Cunningham et al., 2009; Dickinson & Caswell, 2007). Relatedly, the course enhanced teachers' knowledge about six areas of literacy and language development that are "high-priority" instructional targets (e.g., Gallagher, Frith, & Snowling, 2000; Hammill, 2004; National Early Literacy Panel [NELP], 2008; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Storch & Whitehurst, 2002). Three targets (phonological awareness, alphabet knowledge, print awareness) are "code-based" literacy skills (e.g., Justice & Ezell, 2002; Ukrainetz, Cooney, Dyer, Kysar, & Harris, 2000; van Kleeck et al., 1998), whereas the others (vocabulary/linguistic concepts, narrative, social communication/pragmatics) are "meaning-based" language skills (Pankratz, Plante, Vance, & Insalaco, 2007; Storch & Whitehurst, 2002).

Current Study

The current study examined the efficacy of this 14-week course among a diverse group of early childhood teachers. We examined the extent to which teachers who participated in the course (compared to a control group) displayed greater positive changes in their: (a) beliefs emphasizing the central role of the teacher in facilitating children's development of social, literacy, and language skills; (b) knowledge of effective teacher-child interactions; (c) skill to detect effective interactions in video; (d) beliefs about importance of teaching early literacy and language skills; (e) knowledge of the major domains of literacy and language development; and finally (f) use of

effective teacher-child interactions (independently coded from videotapes of their classroom interactions). We also examined the extent to which the effects of the course were greater or less depending on teacher or program features (e.g., teacher education, years teaching experience, type of program, etc.), although we did not anticipate finding such effects. Finally, we examined the extent to which differences between course and control teachers' observed classroom interactions could be explained by changes in belief, knowledge, and skills. We anticipated that differences between groups in belief and knowledge would partially mediate differences in observed teaching practice.

Method

Participants

This study included 440 preschool teachers who participated in an 18-month study of two forms of professional development—a 14-week course and a yearlong consultation. Data for this study include those collected during the course phase of the study. The recruitment process for the professional development study targeted large community preschool and Head Start programs across the country. This resulted in five sites for Cohort 1 starting in spring 2008: New York City; Hartford, CT; Chicago, IL; Stockton, CA; and Dayton, OH. Five additional sites joined the study in Cohort 2, starting in spring 2009: Columbus, OH; Memphis, TN; Charlotte, NC; Providence, RI; and a second set of programs in Chicago, IL. Program administrators and teachers were invited to attend recruitment meetings in each location to learn about the study details. Additional follow-up was done with liaisons and directors by phone and e-mail. Teachers were considered eligible for participation if they were the lead teacher in a publicly funded classroom in which the majority of children were: (a) eligible for kindergarten the following school year and (b) did not have an IEP at the start of the current school year. In addition, in eligible classrooms instruction was in English for the majority of the school day, and high-speed Internet access was available for the teachers' use at the program site. Once teachers agreed to participate, they were randomized at the site location level into the course or control group for the first phase of the study so that approximately half of the teachers participated in each group.

In the final analysis group of 440 teachers, there were 217 teachers in the control condition and 223 teachers in the course condition. The majority of teachers (63%) worked in Head Start programs, and a significant portion worked in public schools (33%). Teachers were experienced, with an average of 11.2 years of experience teaching preschool-age children. Teachers were diverse in terms of educational backgrounds (A.A. degree or less = 40%, B.A. degree = 46%, M.A. degree or higher = 15%). Most of the teachers were African American (47%) or White (31%), with a smaller number of Latino (9%), Asian (3%), and other ethnicities (9%). Descriptive statistics are presented in Table 2 by condition. There were no significant differences in these demographic or work characteristics between the course and control groups.

Table 2 Descriptive Statistics for Covariates by Treatment Group

	Course Condition			Control Condition		
	N	%	M (SD)	N	%	M(SD)
Teach in Head Start program	160	61		174	66	
Teach in a public school building	159	32		173	35	
Teacher education	159			177		
Associate's degree or less		42			37	
Bachelor's degree		45			46	
Master's degree or higher		13			16	
Years of experience: pre-kindergarten	163		11.09 (7.67)	176		11.30 (8.12)

Intervention Description

The course, entitled Support of Language and Literacy Development in Preschool Classrooms Through Effective Teacher-Child Interactions and Relationships, was designed to increase teachers' knowledge about the vital role that teacher-child interactions play in learning and skill acquisition and to build specific skills for observing teacher-student interactions that contribute to language and literacy skills. The course was delivered in 14, 3-hour-long sessions through collaborations with local colleges and universities in each site. In most sites teachers who took the course received 3 units of college credit. There were between 5 and 15 teachers in each course section. Instructors (n = 15) were hired from the local early childhood (EC) community and were typically experienced EC teachers with some experience teaching in a higher education context. A few instructors were officially affiliated with 2-year or 4-year institutions of higher education; most were not. They were provided with instructor manuals, which included PowerPoint presentations, videos, and written assignments for each course section. Instructors attended a weeklong training and were provided with ongoing implementation support by NCRECE staff, including weekly phone calls from course developers. Videotape coding of course sections indicated high levels of implementation fidelity (LoCasale-Crouch et al., 2011).

The first three sessions provided teachers with information on the framework for the course and covered materials such as why preschool experiences are important for long-term development, the importance of teacher-child interactions and relationships for promoting children's development, and introduction to the three broad domains of the CLASS—Emotional Support, Classroom Organization, and Instructional Support. Sessions 4 and 5 focused on Emotional Support, Session 6 focused on Classroom Organization, and Sessions 7 and 8 focused on Instructional Supports. Within each of these sessions, teachers were introduced to the types of interactions that demonstrate effective interactions and exposed to videos in which they analyzed the extent to which these interactions were present or absent. Homework included readings and watching and analyzing additional videos online. Sessions 9 through 11 focused on language development and instruction—introducing teachers to the main domains of language development (vocabulary, pragmatics and social language, and narrative) and spending time watching videos highlighting effective language instruction. Teachers were also provided with

sample language activities and asked to enact these in their classrooms. Sessions 12 and 13 focused on literacy development (print concepts, alphabet knowledge, and phonological awareness) and instruction, following a framework similar to that described previously for language development. In the final session, teachers were asked to film themselves delivering a literacy and language activity and shared their video with fellow teachers—highlighting examples of effective (or ineffective) interactions throughout.

Work by LoCasale-Crouch et al. (2011) demonstrates that the course was delivered with high levels of fidelity. Videotapes of course sessions were scored by NCRECE staff, and all instructors covered material as suggested. Instructors reported completing 95% of course materials. Furthermore, teachers reported that instructors delivered material with very high levels of quality.

Teachers in the control condition received business as usual supports and were not exposed to any of the coursework provided in this study, though they may have been taking other courses at the time.

Measures

Beliefs About Intentional Teaching is an 11-item scale to assess teacher beliefs that children's learning is contingent upon teachers being actively involved with children and providing some opportunities for explicit teaching of literacy skills (Hamre & Downer, 2007). This scale includes items such as "Preschool children are too young to benefit from explicit instruction in early literacy" and "Young children learn all the vocabulary they need from their peers in the context of play." Items are rated on a response scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The internal consistency of this scale for the current study was .67. Despite the lower than ideal internal consistency, expert review of items provided face validity of the construct under study, and this measure is related in expected ways to a similar measure of teacher beliefs consistently linked with effective teaching.

Teachers' Knowledge of Effective Teacher-Child Interactions is a 14-item scale that tests a teacher's understanding of and knowledge about interactions that lead to positive development. The scale consists of multiple-choice items requiring a response to a classroom scenario. Correct answers are based on effective interactions using the CLASS framework for defining (Hamre & Pianta, 2007) and measuring (Pianta et al., 2007) high-quality interactions. One sample item was: "A child in class is shy and does not talk very much. Since this child rarely engages in conversations with either teacher or peers, one way the teacher can facilitate his language development would be: a. Always give each child a turn to share in circle time; b. Model language by describing what she is doing and what other children are doing; c. Enthusiastically engage him in the lesson using a variety of materials; d. Ask him questions which he can answer by nodding or shaking his head." In this case the correct answer was b, as this strategy is most likely to lead to increased language use by the child.

Multiple steps went into development of this measure. First, items were generated and reviewed by experts in this content area to assure face validity of items. Then, items were piloted with existing teachers to assure readability and range in responses. Among the control group only, individual items were examined to assure adequate range of response options. Results indicated that while individual items ranged in difficulty, they all fell within the acceptable range of correct responses ratio to the number of those who answered the question (51%−90%). Additionally, items were examined for discrimination ability by looking at the difference in percentage correct by items for two groups: the highest 27% based on the total score and the lowest 27%, per recommended practice in multiple-choice item discrimination work (Kelley, 1939). On all items, the higher total scoring group exceeded the lower scoring group, meaning each item was able to discriminate between the two groups. Item discrimination ranged from 17% to 61%.

The Video Assessment of Interactions and Learning (VAIL) assessed teachers' skills in detecting effective interactions. Respondents watch two short videos (2–3 minutes each). After each video, participants can identify up to five *strategies* the teacher is using, such as strategies to engage the students in the lesson and hold their attention. Responses are coded for *accuracy* in relation to a standard identified in the CLASS. In the case that a strategy was coded as correct, a *breadth* score was also assigned, to indicate the number of CLASS indicators for a specific dimension that were mentioned in the response. For example, for the CLASS Instructional Learning Formats dimension, there are four indicators: effective facilitation, variety of modalities, student interest, and clarity of learning objectives. The breadth score measures the number of indicators that might be noted within a given dimension.

Research assistants participated in a half-day training session that included viewing the same video clips the NCRECE participants watched, reading and discussing the CLASS manual, practicing and discussing video assessment responses, and independently coding two complete video assessments. Reliability was assessed by comparing the exact matches between the research assistants' codes and the master codes derived from scoring of protocols by three VAIL experts. Research assistants were considered reliable if at least 80% of their codes matched exactly to the master codes. Coders demonstrated strong agreement, with an average exact agreement level of 82.5% on the 20% of the VAILs that were blindly double coded.

Beliefs About Importance of Literacy and Language Skills asks teachers to rate the importance of 12 skills for children as they enter kindergarten, such as "Blend syllables into words." Items are rated on a response scale from 1 (*not important*) to 4 (*essential*). Cronbach's alpha on this instrument for the current study was .87. Results from a prior study of pre-kindergarten teachers indicated that results on this scale are internally consistent with self-reported language and literacy practices (Burgess, Lundgren, Lloyd, & Pianta, 2001).

Knowledge About Language/Literacy Skills was assessed through 12 items in which teachers had to categorize particular skills (e.g., recognize letters in his/her name, use adjectives to

modify nouns in conversations, blend syllables into words) into one of six language/literacy domains: alphabet knowledge, print concepts, vocabulary and linguistic concepts, pragmatics and social language, narrative skills, and phonological awareness. For this study, teachers' overall total correct for language and literacy skills was used. In addition to expert review and piloting with teachers prior to use in this study, items were examined in the control group. In examining individual items, the ratio of correct responses to completed items fell within an acceptable range (54%−85%), except for one item. Teachers were highly consistent (93%) in matching identification of the letters of the alphabet to the domain of alphabet knowledge. Nevertheless, this item was kept in the composite because of the theoretical importance of this knowledge. Additionally, items were examined for discrimination ability by looking at the difference in percentage correct by items for the highest and lowest performing groups. On all items, the higher total scoring group exceeded the lower scoring group, meaning each item was able to discriminate between the two groups (item discrimination ranged from 27% to 58%).

Classroom Assessment Scoring System.

CLASS measures 11 dimensions of interactions using 7-point scales: (a) positive climate, (b) negative climate, (c) teacher sensitivity, (d) regard for student perspectives, (e) behavior management, (f) productivity, (g) instructional learning formats, (h) concept development (i) quality of feedback, (j) language modeling, and (k) literacy focus. The CLASS served both as an outcome measure and as a focus of the intervention; more detailed descriptions are in Table 1. A principal components analysis across over 4,000 preschool and early elementary classroom reveals a three-factor solution: Emotional Support (positive climate, negative climate-reversed, teacher sensitivity, and regard for student perspectives), Classroom Organization (behavior management, productivity, and instructional learning formats), and Instructional Support (concept development, quality of feedback, and language modeling), with alphas of .81 to .89 (Hamre, Pianta, et al., 2010), respectively. The literacy focus dimension does not load with any of these CLASS domains and is thus analyzed separately here. CLASS instructional scales predict growth in language and literacy skills in pre-k (Howes et al., 2008; Mashburn et al., 2008) and first grade (Hamre & Pianta, 2007). Literacy focus, as measured by CLASS, is also associated with growth in children's early literacy skills (Hamre, Justice, et al., 2010). Emotional support and classroom organization have been linked to self-regulatory and social outcomes (Mashburn et al., 2008; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009).

Coders attended a 2-day CLASS training and had to pass the CLASS reliability test, which requires scoring five segments and demonstrating consistently with master codes (80% of codes within 1 point of master code). Average reliability for the Reliability I test was 84%, with a range of 60% to 100%. Coders who did not pass this initial test were provided with feedback and given a second test. Coders who did not pass this second test were assigned to other responsibilities. Throughout the coding period, all coders attended weekly meetings that focused on assessing progress and reliability, as well as addressing issues of potential drift. During these meetings 89% of codes were within 1 point of the master code.

Procedures

Teachers completed an online questionnaire within the month following the end of the course. This questionnaire included all teacher belief, knowledge, and skill measures described previously. Teacher use of effective-teacher child interactions was coded from videotapes teachers submitted to the research team. All teachers were provided with a digital video camera and digital video (DV) cassettes at the teacher training and with detailed documentation and training on how to use the camera. Teachers sent in four DVs during the course phase of the study, each recording 30 minutes of class time focused on literacy and language instruction. Two 15-minute segments were CLASS coded from each 30-minute DV. The first segment was always from minutes 00:00 to 15:00 and the second from minutes 15:01 to 30:00. If tapes did not run for the full 30 minutes CLASS codes were assigned if at least 8 minutes of video were available. Coding was randomly assigned to raters at the segment level. Each segment was double-coded. The segments that were selected for this study were taped by teachers during the end-of-course time frame for each site. End-of-course was defined as tapes that were taped between the midterm date of the course and 2 weeks after the last day of class. This time frame is not ideal for capturing post-course differences because some of the segments were taped prior to teachers completing the course. Post-midterm content focused primarily on instructional supports, with a heavy focus on literacy and language instructional strategies. Although we anticipate that the use of this time frame for videos may decrease effect sizes on observed practices, previous work has suggested that using more than one video of classroom practices can enhance the reliability of estimates of teacher's use of effective practices (Mashburn, Downer, Rivers, Martinez, & Brackett, 2010).

Data Analysis

Analysis focused on whether, compared to teachers in the control condition, teachers in the course condition had stronger beliefs regarding the importance of intentional teaching of literacy and language skills, higher levels of knowledge about effective teacher-child interactions and language and literacy domains, and higher quality of observed teaching practices. All teachers assigned to a treatment condition (n = 440) were included in these intent-to-treat analyses, including a number of teachers who signed up for the study but never participated. Using data from all teachers assigned to a treatment condition provides the most robust test of treatment effects. Most teachers had outcome data on the teacher report measures (67%). Slightly fewer (56%) had data on the video assessment (VAIL) due to some problems viewing the video online. There were also fewer teachers with observational data (56%) due in part to the fact that one course section was run during the summer and those teachers were not currently teaching. Finally, 75% to 79% of the teachers had data on the demographic and background measures. The most common reasons for missing data were teachers who dropped out of the study due to other time commitments.

Due to the high rates of missing data, all analyses described in the following were performed on 10 imputed complete data sets (N = 440). Multiple imputation (MI) or data augmentation was carried using the MI procedure in SAS. All analytic variables, including nine dummy variables indicating study site, were used in the imputation, and all teachers (n = 440) were included in the multiple imputation procedure. In addition to the analytic variables discussed previously, we also included CLASS measures collected at the beginning of the school year. The MI procedure uses Bayesian simulation methods to perform the imputation, and the Monte Carlo Markov Chain algorithm used a single chain for each of the 10 imputed data sets. Five thousand burn-in iterations of the algorithm were performed before the first imputation and 1,000 iterations were used between imputations.

As noted previously, in one of the sites the course was given in the summer and therefore did not occur during a period in which they could be observed teaching. Preliminary analysis of the data revealed that the values for the CLASS measures imputed for these teachers resulted in large and highly variable between imputation site effects. This suggested that for these teachers, the imputation procedure did not have enough information to produce plausible values for the missing CLASS measures. Although we included these teachers in the imputation procedure and in other analyses presented in the article, teachers from this site were excluded from all analyses that involved CLASS measures.

Mixed effects, multiple regression/ANCOVA analyses were conducted and included as covariates teacher education and experience and whether the program was located in a public school or was a Head Start program. In addition, a set of dummy variables was entered that captured variation in each outcome across the sites included in our study. In most cases, teachers within the same site were invited to attend one of two courses. Although we include site as a fixed effect, we took an additional precaution of allowing the residuals among teachers within the same course to be correlated. For teachers in the same course their residual variance covariance matrix was assumed to have a block diagonal structure with a variance that was constant throughout the sample (diagonal elements) and constant covariance terms (off-diagonal elements). This structure was repeated for every course and the covariance estimates across courses were constrained to be equal. Teachers in the control condition were assumed to have uncorrelated error terms and a constant variance—we effectively assigned them to their own course. Some of the teachers in the treatment condition did not attend a course, either because of a time conflict or because they dropped out of the study entirely. We treated these teachers in the same manner as the teachers in the control condition and assumed that their errors were independent. The analysis on the multiple imputed samples was carried out using the MIXED procedure in SAS. We used the REPEATED statement to model the residual correlations among teachers within the same course. For some of the imputed data sets (~6%), the mixed models did not converge. In these cases, we dropped the REPEATED statement and assumed independent errors. The estimates obtained from each imputed sample were integrated using the MIANALYZE procedure in SAS.

The overall analysis strategy involved first estimating treatment effects using these factors as covariates and then asking whether they moderated the anticipated treatment effects on knowledge and practice. To assess the degree to which differences in observed teaching practice may be mediated by differences in teachers' beliefs and knowledge, we tested each indirect path between treatment and the individual measures taping knowledge separately. These knowledge and belief measures were entered separately because they were not highly correlated with one another and could not be reliably combined into a single factor. The estimates for the indirect effects were obtained using path analysis and are a product of two coefficients. The first coefficient, the "a path," is the coefficient for the treatment effect on the mediator. This coefficient comes from a regression of the mediator on treatment as well as the set of covariates (e.g., teacher education) discussed previously. The second coefficient, the "b path," is the coefficient for the effect of the mediator on the outcome, controlling for treatment status. It comes from a regression of each outcome on the treatment indicator variable and the mediator. The set of covariates are also included in the estimation of b paths.[1] The level of statistical significance of the indirect paths, "a × b," were based on a Sobel test.

Results

The results for the regression/ANCOVA models that included treatment, educational setting, and teacher education and experience are presented in Tables 3 and 4. The first two columns report the number of non-missing values, unadjusted means, and standard deviations for the treatment and control groups. The third column reports the effect size and *p* value from the treatment coefficient in the ANCOVA analysis conducted on the multiply imputed data. The effect size is calculated as the ratio of the regression coefficient for the treatment group indicator variable (numerator) and the square root of the error variance (denominator) obtained from the estimated residual variance-covariance matrix and averaged over the 10 imputed data sets.

Table 3 Course Effects on Teachers' Beliefs, Knowledge, and Skills

	N	Course M (SD)	Control M (SD)	Effect Size
Beliefs about intentional teaching	296	3.74 (.65)	3.53 (.59)	.43***
Knowledge of effective interactions (multiple choice)	297	79.19 (15.23)	69.05 (14.37)	.77***
Ability to identify effective interactions (VAIL breadth score)	248	5.72 (3.41)	3.91 (2.68)	.60***
Beliefs about importance of	297	3.49 (.40)	3.22 (.49)	.65***

literacy and language skills				
Knowledge about literacy and language skills	297	76.93 (16.61)	69.08 (19.15)	.49***

Note. The first two columns report the number of non-missing values, unadjusted means, and standard deviations for the treatment and control groups. The third column reports the effect size and p value from the treatment coefficient in the ANCOVA analysis conducted on the multiply imputed data. VAIL = Video Assessment of Interactions and Learning.***p<.001.

Table 4 Course Effects on Observed Teacher-Child Interactions (Classroom Assessment Scoring System; CLASS)

	Course M (SD)	Control M (SD)	Effect Size
Emotional Support composite	5.44 (0.43)	5.24 (0.56)	0.41*
Positive climate	5.54 (0.63)	5.32 (0.78)	0.31
Negative climate	1.19 (0.28)	1.23 (0.37)	20.22
Teacher sensitivity	5.02 (0.66)	4.82 (0.72)	0.29
Regard for student perspectives	4.38 (0.65)	4.04 (0.82)	0.45**
Classroom Organization composite	5.48 (0.51)	5.31 (0.65)	0.28
Behavior management	5.71 (0.73)	5.58 (0.85)	0.15
Productivity	6.04 (0.57)	5.89 (0.72)	0.19
Instructional learning formats	4.7 (0.57)	4.47 (0.75)	0.35*
Instructional Support composite	3.00 (0.62)	2.59 (0.64)	0.66***
Concept development	2.68 (0.74)	2.22 (0.69)	0.68***
Quality of feedback	3.11 (0.62)	2.76 (0.72)	0.49***
Language modeling	3.2 (0.77)	2.77 (0.77)	0.57***
Literacy focus	2.22 (0.82)	2.09 (0.80)	0.19

Note. The first two columns report the number of non-missing values, unadjusted means, and standard deviations for the treatment and control groups. The third column reports the effect size and p value from the treatment coefficient in the ANCOVA analysis conducted on the multiply imputed data. *p<.05. **p<.01. ***p<.001.

Effects of Course on Teachers Belief, Knowledge, and Skills

As can be seen in Table 3, the teachers in the course treatment group endorsed more intentional teaching beliefs (effect size = .43), displayed better knowledge about effective interactions (effect size = .77), and were better able to specifically identify multiple aspects of effective

instruction in video (effect size = .60). Teachers in the course condition also were more likely to report that language and literacy skills were essential to young children's development (effect size = .65) and displayed greater knowledge about these skills (effect size = .49).[2]

Effects of Course on Observed Teacher-Child Interactions

Table 4 reports on results of the ANCOVA for observed teacher practices, using the CLASS. Analyses conducted at the CLASS domain level demonstrated effects of the course on teachers' provision of emotionally supportive interactions (effect size = .41) and instructionally supportive interactions (effect size = .66). There were not significant effects on observations of teachers' use of classroom organization and management interactions.

Because the course provided content specific to each of the CLASS dimensions, these analyses were also run at the dimension level. Results indicate that within the Emotional Support domain teachers in the course condition demonstrated more child-focused and autonomy supportive interactions (regard for student perspectives, effect size = .45). Although the Classroom Organization domain results were not significant, teachers in the course condition did display a greater ability to engage children in instructional opportunities (instructional learning formats, effect size = .35). Within the Instructional Support domain, teachers in the course demonstrated more effective use of strategies that encourage higher-order thinking skills (concept development, effect size = .68), more frequent and intensive feedback (quality of feedback, effect size = .49), and more effective use of language facilitation strategies such as open-ended questions, contingent conversations, and expansion of child talk (language modeling, effect size = .57).

Is the Course More Effective for Certain Types of Teachers?

The second set of analyses tested whether teacher characteristics or type of program moderated the treatment effects. None of the interactions were statistically significant; thus, the course was equally effective across teachers with a diverse range of educational backgrounds and across those working in Head Start and other types of early childhood programs.

Are Differences in Observed Teacher-Child Interactions Explained by Differences in Teacher Belief, Knowledge, and Skills?

We conducted path analysis examining the extent to which differences in course and control teachers' belief, knowledge, and skill in detecting effective interactions mediated the differences in observed teaching. Separate analyses were conducted for each CLASS domain and potential mediator. There was very limited evidence to support the hypothesized meditational models. We observed one statistically significant indirect path, and it involved the Instructional Support domain and the VAIL breadth score—a teacher's ability to describe a broad range of effective interactions from the video ($z = 2.02$, $p < .05$). Figure 2 provides a visual representation of the meditational pathway, including standardized coefficients for each path.

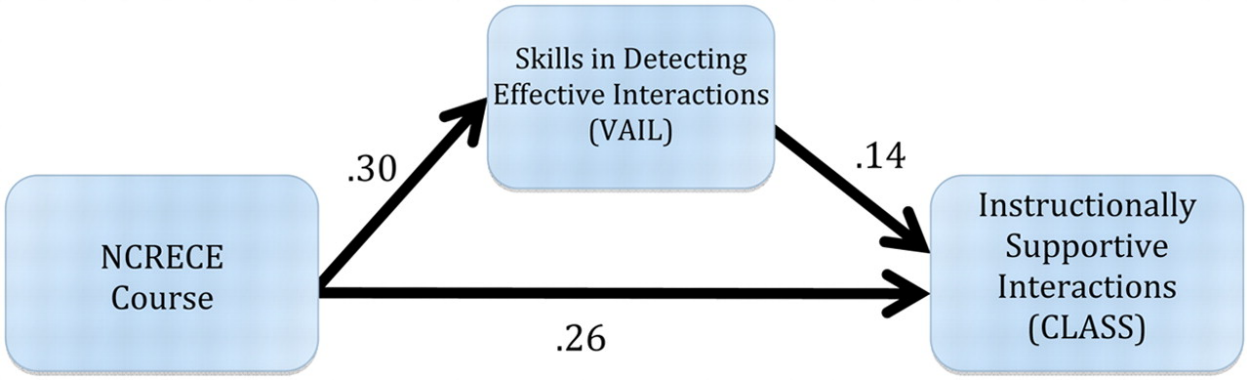

Figure 2. Skills in detecting effective interactions (VAIL) partially mediate association between treatment assignment and observed Instructional Support (CLASS). Note. Paths represented by standardized coefficients, all $p < .05$. NCRECE = National Center for Research on Early Childhood Education; VAIL = Video Assessment of Interactions and Learning; CLASS = Classroom Assessment Scoring System.

Discussion

Recent research and policy initiatives focus attention on the importance of teachers' daily interactions with children in early childhood settings and point out the general low levels of such assets (Dickinson & Brady, 2006; Howes et al., 2008; Jackson et al., 2006; Mashburn et al., 2008). The present study demonstrates that an in-service course can improve the quality of teachers' interactions with children, without providing any feedback or coaching on teachers' own classroom practice. Among a group of 440 early childhood teachers, half were randomly assigned to take a 14-week course on effective teacher-child interactions. This course used the Classroom Assessment Scoring System to organize, describe, and demonstrate effective interactions and how interactions can promote language and literacy skills. Compared to teachers in a control condition, those who took the course reported more intentional teaching beliefs and demonstrated greater knowledge of and skills in detecting effective teacher child-interactions. Teachers in the course also reported stronger beliefs about the importance of teaching children early literacy and language skills and demonstrated greater knowledge about these skills. And importantly, teachers who took the course demonstrated more effective emotional and instructional practices in interactions with children. These results add to the growing literature on effective interventions for early childhood professionals that documents explicit efforts to change teachers' classroom practices (Bierman et al., 2008; Domitrovich et al., 2008; Hsieh et al., 2009; Pianta et al., 2008; Raver et al., 2008). Because the course was equally effective across teachers with less than an associate's degree as well as those with advanced degrees, it could meet a broad set of needs in the professional workforce. And there was limited, but suggestive, evidence that a portion of the benefits of the course for improving teachers' interactions was a function of its impact on teachers' skill in detecting effective interactions in video.

Effects of Course on Teachers' Beliefs, Knowledge, Skills, and Practice

NCRECE designed a course to improve teachers' beliefs, knowledge, and skills in two broad domains—effective teacher-child interactions and children's language and literacy development. Across domains, the study indicated significant effects of the course on all measures of belief, knowledge, and skill, with moderate effect sizes ranging from .41 to .72. Teachers in the course were more likely to endorse the importance of teachers taking an active role in children's learning and demonstrated better knowledge of specific interactional strategies. They also were better able to identify effective teacher-child interactions in video. Given evidence that teachers who use these practices in the classroom have children that make greater academic and social gains, this type of knowledge may be important (Howes et al., 2008; Mashburn et al., 2008).

The second broad domain of belief and knowledge that the course targeted was in relation to young children's language and literacy skills. Research has indicated great variability in teachers' beliefs about the developmental appropriateness of teaching young children literacy and language skills in early childhood settings (Hindman & Wasik, 2008). Within this study, teachers were asked to rate the importance of a set of skills for children entering kindergarten, including skills such as blending syllables into words, recognizing the letters in their names, and mapping spoken word to print. Although all teachers tended to report these skills as important, teachers in the course condition reported these skills as more important than did teachers in the control group. Teachers' knowledge about children's literacy and language skills was also assessed, and teachers in the course group displayed significantly greater knowledge.

Most importantly, the course improved the quality of teachers' emotional and instructional interactions with children. Effects sizes are comparable to those from intervention studies using coaching and/or curricular models (e.g., Domitrovich et al., 2008; Pianta et al., 2008; Raver et al., 2008). In relation to teachers' use of emotionally supportive interactions, teachers who participated in the course were observed to display more support for children's autonomy. These types of emotional supports are important to the development of children's motivation and social adjustment (Gutman & Sulzby, 2000; McCartney et al., 2007; Valeski & Stipek, 2001). Although differences in observed practice were relatively small, there is evidence that small, incremental differences within the moderate to high end of these emotional support dimensions are associated with more positive social development among children (Burchinal, Vandergrift, Pianta, & Mashburn, 2010). There were not significant changes in the other dimension within Emotional Support, but all differences were in the expected direction. It may be that regard for student perspectives, which focuses on providing children with more choices, leadership opportunities, and freedom in the classroom, is easier to change based on didactic course-based instruction than are climate aspects of the classroom or teachers' sensitivity, which may be more closely tied to psychological characteristics of teachers. Interestingly, coaching interventions have demonstrated significant changes in these aspects of teacher-child interactions, suggesting, perhaps, that teachers need more individualized support in the context of a relationship to change these types of emotionally supportive interactions (Pianta et al., 2008; Raver et al., 2008).

Stronger effects were observed in the teachers' use of effective *instructional* interactions. Teachers who participated in the course were observed to use more strategies that facilitate children's higher-order thinking skills, provided more intensive and frequent feedback, and better supported children's language development. It is these aspects of the classroom environment that appear to have the strongest associations with children's early literacy, language, and cognitive development (Mashburn et al., 2008). Effect sizes were moderate, and Instructional Support scores for the course condition were in the range that recent threshold analyses suggest are required to produce positive early academic and cognitive outcomes for children (Burchinal et al., 2010).

There were not significant differences between the course and control groups on the extent to which they used effective classroom organization and management techniques. It may be that there was not sufficient time spent on this area of practice. There was only one course session covering all dimensions with Classroom Organization, whereas there were multiple sessions for Emotional Support and Instructional Support. Alternatively, it may be that the data collection methods in this study inhibited our ability to detect significant differences in this domain. Overall mean scores were high, particularly in relation to observed behavior management and teachers' effective use of time. Because teachers were asked to send in brief (30 minute) tapes, it may be that it was relatively easy to score high on these dimensions for such a short period. This possibility is supported by evidence that mean scores on these dimensions of teacher-child interactions are slightly higher than those observed in national samples of live observational data of pre-k classrooms (Pianta et al., 2005). Several other studies examining the effects of teacher-focused interventions on classroom interactions similarly have failed to show changes in classroom organization as measured by CLASS (e.g., Brown et al., 2010; Domitrovich et al., 2008; Raver et al., 2008). Future work might include other observational measures of these types of interactions to help determine the extent to which these elements of interactions are simply harder to change or whether the CLASS Classroom Organization domain is not as sensitive to intervention effects.

We also did not detect significant differences between course and control teachers' use of explicit and purposeful literacy interactions—both groups were observed to use these types of interactions very infrequently. Other interventions targeting teachers' use of these strategies have demonstrated effectiveness (Justice, Kaderavek, Fan, Sofka, & Hunt, 2009); however, studies have also suggested that getting teachers to consistently adopt these strategies is challenging (Hamre, Justice, et al., 2010), particularly in the context of a diverse set of teachers with very disparate beliefs regarding the extent to which this type of instruction is developmentally appropriate.

Within this sample, there was considerable range in teachers' beliefs about explicit instruction in literacy. Examination of item-level data on beliefs measures suggests that among control teachers, 49% strongly disagreed with the item "Preschool children are too young to benefit from explicit instruction in early literacy." However, 23% of control teachers either agreed or strongly

agreed with this statement. Within the course condition, only 8% of teachers agreed or strongly agreed with this statement at the end of the course. So, as noted earlier, we seem able to change beliefs in this area, but these changes in belief may not be sufficient to change practice. It is important to note that this dimension of teaching was the very last to be covered in the course and thus the limitation, discussed in more detail in the following, that tapes coded for this study included any tape received between the midterm and 2 weeks after the final may have minimized observed impacts on this dimension of teaching.

Given that the course explicitly taught teachers the CLASS, we must be concerned with the possibility that the observed improvements in interactions are the result of "teaching to the test" rather than representing more meaningful changes in practice. Our experience suggests that because the CLASS describes broad dimensions of teaching practice that require intentional engagement of teachers with children over time, rather than providing a simple checklist (e.g., asks four open-ended questions), it would be hard for teachers to demonstrate improvements on CLASS scores without making meaningful changes to their practice. Our ability to test this hypothesis is limited at this time but will be addressed in later phases of the NCRECE study. We will assess evidence of long-term changes in practice (1 and 2 years after the course) as well as examine the potential impact of the course on gains in children's learning and social development. We do have evidence from previous coaching research suggesting that an explicit focus on CLASS can lead to improvements in child outcomes (Downer et al., in press; Mashburn et al., 2010), but whether the course will demonstrate similar effects is yet untested.

An encouraging pattern of findings across all beliefs, knowledge, and skill outcomes is the fact that course effects were consistent across sites, teacher education level, program type, and program location. In other words, teachers benefited from participating whether they were from one part of the country or another, had a B.A. or not, worked in Head Start or under some other auspice, and had classrooms in a school or not. Thus, this type of course may be useful to a broad subset of the current early childhood education workforce.

Teacher Beliefs, Knowledge, and Skills as Mediators of Course Effects on Teachers' Interactions With Children

Although we found evidence of changes in beliefs, knowledge, and practice, we also wanted to test the theory of change model by assessing whether changes in teacher beliefs and knowledge mediated effects on observed changes in teaching practice. We found limited support for this meditational pathway. There was evidence that teachers' skill in detecting effective interactions in videos partially mediated course effects on instructional interactions. Although these results are preliminary, they are among the first to provide empirical evidence regarding a potential pathway through which courses may have impacts on teachers' practice. It is possible that the portions of the course that focused on having teachers analyze classroom video in very specific ways were among the most important for helping teachers use these practices in their classrooms. This finding is consistent with a large body of work on "teacher noticing" that has documented

the importance of video analysis for helping teachers to view and enact practices in their classrooms (e.g., Star & Strickland, 2008; Van Es & Sherin, 2002). It is also important to note that the mediator was not randomized, thus we cannot infer causal associations (MacKinnon, Fairchild, & Fritz, 2007).

None of the other measures of belief or knowledge were significant mediators of the course effects. There are several potential reasons for this lack of findings. First, it may be that connections between teacher beliefs, knowledge, and practice are too weak to support the proposed theory of change. That is, interventions that primarily target beliefs and knowledge may have limited impacts on teachers' practice unless they directly focus on practice. This course did impact teachers' use of effective practice, but findings suggest that this may be because much of the course content focused explicitly on observing and reflecting on practice. The fact that the only aspect of beliefs, knowledge, and skill that did show some evidence of mediation was the measure of teacher skill in detecting effective interactions provides some support to this interpretation.

However, it may also be that our measures are too imprecise to effectively model connections between course participation, teacher belief and knowledge, and teacher observed practices. Most of the measures of belief and knowledge used in this study were newly developed, and some have less than ideal psychometric proprieties. It is possible that there would be a stronger association detected among these constructs if there were less measurement error.

Limitations

Although this randomized, controlled study demonstrated effects of a course on teachers' belief, knowledge, and practice, there are several notable limitations. First, the study relied on videotapes of teachers practice collected between the midterm and 2 weeks after the final. Although this study does confirm that significant intervention effects can be observed using this video-based methodology (Pianta et al., 2008), in which teachers do their own filming and are able to be selective in what areas of practice are observed, we expect that it may limit our ability to detect significant changes in practice, particularly among the dimensions of teacher-child interactions, which may be most susceptible to this methodology. For example, although ratings on negative climate are low across national samples, ratings in this sample were extremely low and there was very little variability. It may be that if teachers filmed segments in which they got angry or frustrated with children that they decided not to send these in or to erase the segment and film again. Live observations were conducted in the school year following the course, so future analyses will test the extent to which this hypothesis is supported.

A second limitation of the videotape methodology concerns the timing of the videotapes. Because the course was typically offered during the spring, just as teachers were finishing teaching for the year, there was limited opportunity to observe teaching after the full treatment was delivered. Based on previous evidence suggesting that it is important to observe on multiple

days to provide a reliable estimate of teacher-child interactions using this video methodology (Mashburn et al., 2010), we determined that it was necessary to create composite scores based on two tapes, whenever possible. This meant that for most teachers at least one of the two tapes coded for this study was filmed shortly after the midterm, before they had much introduction to the Instructional Support domain or effective literacy and language instruction. Given this significant limitation, the moderate effect sizes observed on teachers' use of effective instructional interactions are notable. That said, examining the extent to which these practices are enacted in a cleaner sample of postintervention teaching would be preferable.

These intent-to-treat analyses were conducted using all participants, including a number of teachers assigned to the course condition who rarely, if ever, attended the course. Subsequent treatment-on-the-treated analyses that examine the extent to which particular elements of participation (e.g., attendance, class participation, homework completion) were associated with changes in teachers' belief, knowledge, and practices will provide us with much more detailed information about the active ingredients of the intervention.

A final set of limitations concerns the selection and treatment of teachers in this study. Teachers volunteered to participate in this study. We cannot assess the extent to which these teachers varied from the larger population of teachers in each site or the ways in which volunteering may alter the effects of the course as compared to teachers who were required to take it. Additionally, the control teachers were assigned to business as usual and not assigned to any of the specific coursework provided in this study. Future studies should test the effects of this course against a group of teachers receiving different coursework to more fully demonstrate the unique effects of this particular course and guard against the potential of a Hawthorne effect. Finally, this course was delivered with in-service teachers, and we cannot assume that similar results would be obtained with pre-service teachers. Pre-service teachers would have a different set of educational background than the current participants and those without significant teaching experience may need a different set of resources to help them make meaning of the types of interactions described and displayed in this course. Scott-Little et al. (in press) report on the implementation of this course in a pre-service context and suggest that instructors and teachers in these contexts find the course useful while highlighting some of the unique challenges to implementing in these higher education contexts.

Conclusion

This study is among the few to show direct effects of a course on early childhood teachers' use of effective teaching practices. Consistent with arguments made by Neuman and Cunningham (2009) and Zaslow, Tout, Halle, and Starr (2010), findings from this study provide support for the efficacy of *practice-focused* professional development. However, definitions of practice-focused professional development, which have thus far typically been defined as occurring "one-on-one or in small teams within the early educators own classrooms" (Zaslow et al., 2010, p. 426), should extend to include courses that have an explicit focus on practice. This is important

because as the field looks for ways to improve the quality of teacher-child interactions at scale, there is a need for professional development opportunities that can be disseminated broadly. Courses offer an advantage over more intensive options such as coaching in that they are less expensive to implement and easier to integrate into existing systems for teacher licensure. For example, the Head Start Act requires 50% of Head Start teachers to have a B.A. degree by 2013—thus many current Head Start teachers are enrolling in B.A. programs. For this and similar policy interventions to be successful in producing the intended positive outcomes for children, it is important that the courses teachers take actually change the ways they approach classroom teaching. Learning more from this study and other similar efforts to use courses to lead to meaningful and sustained changes in teachers practice should help inform the way the field moves forward in the broader context of early childhood quality improvement efforts.

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Notes

1 Although causal inferences regarding the effect of treatment assignment are not dependent on the "no confounders" assumption because of random assignment, the mediators of treatment, teacher knowledge and beliefs, were not randomly assigned. Thus, the covariates in the model estimating the b path can be considered control variables, and their presence in the model strengthens causal inference.

2 Teachers in Cohort 1 of the study completed all knowledge and belief measures prior to the course. These pre-course measures were eliminated from the study for Cohort 2 due to concerns from teachers regarding the length of the survey. However, among Cohort 1 we tested the extent to which treatment assignment was associated with increases in knowledge and significant changes in belief. Results from these analyses parallel those reported here on post-treatment differences—teachers in the course condition gained more knowledge and reported an increase in beliefs about the importance of language and literacy skills and intentional teaching practices. Results are available upon request.

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