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An Analytic Study of the Professional Development Research in Early Childhood Education

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Research Findings

The goal of this study was to examine empirical research on the design, delivery, and measurement of the effects of professional development (PD) for early childhood educators in order to provide insight into what the field has accomplished as well as suggest directions for future PD programs and research. Through the use of rigorous inclusion criteria outlined by S. M. Wilson, R. E. Floden, and J. Ferrini-Mundy (2001), 73 studies were included and analyzed. On average, 25% (M = 12.68, SD = 9.99) of references in each study were specifically about PD. The majority of studies (n = 39) targeted some form of language and literacy instruction, whereas only 5 studies targeted math and 1 study targeted science. A total of 35 different delivery mechanisms were used to provide PD, with 40 studies including some form of coaching and 45 including training workshops. The studies used a wide range of methods to measure PD-related outcomes: 51% (n = 37) of studies examined changes in teacher practice, 18% (n = 13) measured changes in teachers' knowledge, 40% (n = 29) measured changes in children's learning, and 11% (n = 8) measured changes in children's behavior. *Practice or Policy:* Based on the results of this study, there are 4 major ways in which PD for early childhood educators can be developed. Researchers and providers of PD should (a) continue to draw from multiple resources to inform PD implementation designs, (b) include more diversity in the content of instruction targeted by PD, (c) experiment with innovative formats for delivering PD, and (d) create better means of evaluating PD.

There is growing consensus that professional development (PD) is an especially important lever for improving teaching practice in early childhood education (ECE). Teachers' experiences with PD have been linked to higher classroom quality (Burchinal, Cryer, Clifford, & Howes, 2002), and some researchers suggest that PD might be the most impactful way of improving children's learning above and beyond teacher degree attainment or specific curriculum selection (e.g., Early et al., 2007; Preschool Curriculum Evaluation Research Consortium, 2008). Given the importance of PD for improving instruction in ECE, the field needs a better conception of what researchers are currently doing with PD in order to understand the growing knowledge base and find gaps in knowledge that need to be addressed. To that end, the present study systematically examined empirical research on the design, delivery, and reported measurement of the effects of PD for teachers of young children in order to provide insight into what the field has done as well as suggest directions for future PD programs and research.

Literature Review

Although there are many theoretical discussions of what constitutes high-quality PD, this literature remains relatively vague, providing little guidance for those designing and implementing PD. There seems to be an emerging consensus about what PD should accomplish, but not much direction is given on how to accomplish it. For example, Buysse, Winton, and Rous (2009) surveyed teachers, administrators, professors, and others to reach a general definition of PD for ECE. They defined *PD* as "facilitated teaching and learning experiences that are transactional and designed to support the acquisition of professional knowledge, skills, and dispositions as well as the application of this knowledge in practice" (p. 239). The terminology of *skills, knowledge*, and *dispositions* is prevalent in the early childhood PD literature (e.g., it is used by Fukkink & Lont, 2007; Sheridan, Edwards, Marvin, & Knoche, 2009; Snyder, Hemmeter, & McLaughlin, 2011) and even appears in the National Association for the Education of Young Children (NAEYC; 1993) position statement on PD. The implication then is that PD programs for early childhood educators need to be designed and

delivered in a way that targets all three of these key elements—teachers' skills, knowledge, and dispositions. However, many documents do not specifically define these terms or how they translate into the design and delivery of PD. Moreover, there is little empirical evidence to document that targeting teachers' skills, knowledge, and dispositions results in improved outcomes for children.

In addition to these terms, many other terms, such as *sustained* and *hands on*, are used in the theoretical PD literature but are not well defined. This leaves PD designers the task of determining what length and design of PD constitutes sustained and hands on. The vagueness in the guidelines for those actually designing and carrying out PD programs brings into question how researchers can target these areas in ways that impact teachers.

This lack of specificity is a common problem in the overall PD literature. In their 2008 review of the K–12 research on PD, Wayne, Yoon, Zhu, Cronen, and Garet observed that there is a growing agreement about what defines and constitutes good PD for teachers but that this consensus "lacks sufficient specificity to guide practice" (p. 470) when designing and implementing PD. They noted that there is a common consensus that one-off workshops generally do not work and that teachers need sustained and intensive PD but that it is unclear how to define *sustained* or *intensive*. These concerns have also been noted by researchers in ECE (e.g., Wasik & Hindman, 2011). Dickinson, Freiberg, and Barnes (2011) observed that PD often uses theory to decide which child abilities to target, yet there is limited theory to guide or understand how the PD itself will impact teaching in ways that lead to children's learning. How researchers choose to draw from, interpret, implement, and examine the theories of successful PD is especially important for understanding the effectiveness or usefulness of the theoretical literature. Therefore, it is important to understand how researchers are translating theory into the design of PD.

Empirical evidence is needed to determine whether theories on PD actually lead to teacher learning, changes in practice, and improved outcomes for children. This is especially important considering that much of the theoretical literature is written as a reaction to more traditional forms of PD, which are generally not effective in facilitating teacher learning (Ball & Cohen, 1999; Neuman & Kamil, 2010). Looking across the empirical literature is a necessary step for

understanding the relationship between theory and research and identifying patterns of effective practice.

The review methodologies and the research questions posed in this study differ from those in existing reviews of the PD literature. Until recently, broad examinations of the ECE literature generally examined PD as only a correlate or indirect variable in studies of overall quality of care for young children (e.g., Early et al., 2007; Peisner-Feinberg et al., 2001; Phillips, Mekos, Scarr, McCartney, & Abbott-Shim, 2000; Vu, Jeon, & Howes, 2008). Some researchers, however, have begun to review the PD literature based on the type of instruction or the content area targeted, specifically PD related to language and literacy instruction. Fukkink and Lont (2007) conducted a meta-analysis of training impacts on teacher-child interactions and Zaslow and colleagues (2010) conducted a review of specific features of PD including developing children's language and literacy skills. Little work in ECE has examined PD targeting teacher learning related to other types of instruction or content areas, such as math, science, or children's socioemotional development, and this is a critical gap in the research, specifically in understanding the design of PD. Other reviews of the PD literature, such as reviews by Gupta and Daniels (2012) and Aikens and Akers (2011) of PD using coaching, are specific to one type of PD format and do not provide an overall view of the practices used to implement PD in general. Snyder and colleagues (2012) conducted a review examining the recipients of PD across a wide range of PD offerings. The present study, however, examines PD targeting all content areas, is not specific to a particular PD model, and uses rigorous study inclusion criteria (described in the next section).

Information about how researchers measure and account for changes related to PD seems to be missing in currently available reviews of the PD literature, specifically in ECE. Measuring high-quality teaching and practice is a difficult task (Kennedy, 2010), but a more detailed conceptualization of changes in teaching practice as a result of PD is crucial to understanding the overall process of PD. Some researchers have suggested that experts do not know enough about the specifics of PD to determine the active ingredients that make it successful (e.g., Powell & Diamond, 2011; Wasik & Hindman, 2011), and examining change may help provide insight into this process. An understanding of how researchers are evaluating the impact of PD and

what it affects (e.g., the classroom environment, teachers' practice, or children's outcomes) would provide critical information about the overall process of PD. Teacher education researchers S. M. Wilson, Floden, and Ferrini-Mundy (2001) found that measurement was a common issue in studies of teacher preparation and that measurement tools used by researchers often made it difficult to draw conclusions about the efficacy of the teacher preparation designs. Much could be learned about PD and the current state of ECE from examining how researchers are approaching measurement.

In summary, despite the growing consensus that PD is an important lever for improving children's outcomes, (a) the field lacks a clear definition of what it means to target teachers' skills, knowledge, and dispositions and an understanding of whether targeting these areas impacts teaching and learning; (b) there is little work examining how theory informs ECE PD; (c) previous reviews of PD have only focused on specific topics, not providing a broad picture of the larger corpus of PD; and (d) there is no clear understanding of how researchers measure and account for changes related to their PD. A clearer understanding of what the field has accomplished through empirical PD research is necessary. This work can inform those attempting to conduct and research professional learning in ECE as well as suggest directions for future PD programs and research.

The Current Study

A crucial part of the PD literature review process is defining what constitutes high quality in order to construct a framework for making assertions about claims in the literature. Including research that demonstrates strong validity helps ensure that conclusions drawn from this research are dependable and replicable. If the field is going to construct a knowledge base that is derived from the existing research, then the studies need to be rigorously vetted in order to ensure that the knowledge base is empirically sound. Inclusion criteria for rigorous research outlined by S. M. Wilson et al. in their 2001 gold-standard review of teacher preparation programs were used to identify the body of literature for review. The following research questions were posed:

1. How does the empirical research in the ECE field report the design of PD?
2. How does the empirical research in the ECE field report the delivery of PD?
3. How does the empirical research in the ECE field evaluate the success of PD?

Methods

Search Strategy and Selection Criteria

The goal of this analysis was to examine empirical research on the design and implementation of PD for teachers of ECE. In order to be as inclusive as possible, I used several search strategies to collect studies. A search of Educational Resources Information Center [CSA Illumina], Education Abstracts, Sociological Abstracts, and Web of Science (formerly ISI Web of Science) with the criteria *early childhood* and *professional development* or *teacher training* or *teacher education* or *staff development* or *staff training* or *daycare training* or *provider training* was conducted. These multiple terms for ECE teachers were used, as there are multiple ways of referring to ECE educators across the field. Terms related to family day care providers were not specifically searched, as this population is often considered a separate teaching population (Fugligni, Howes, Lara-Cinisomo, & Karoly, 2009). One study of PD for family day care teachers did appear in the search, and this was included in the analysis because it met all of the other criteria. Because this is a relatively new field, most of the empirical studies of ECE PD did not start until the 1990s, but in order to be as comprehensive as possible, I did not use any specific start date to limit inclusion; the earliest study was published in 1995 (Cassidy, Buell, Pugh-Hoese, & Russell, 1995), and the end date for inclusion was December 2012. This initial search generated more than 30,000 findings.

The methodology for the inclusion of empirical research in this study was based on previous well-accepted practices in the field (S. M. Wilson et al., 2001; see the Appendix for more detail). Following this standard, studies were included if they met the following three criteria:

- Criterion 1: Published in a scientific, peer-reviewed journal
- Criterion 2: Addressed the content of the research questions
- Criterion 3: Met generally accepted standards for a variety of research methodologies and described the methods of investigation and analysis (this included describing the PD design and process and providing data or examples of data depending on the type of research and outcomes or results of the intervention or experiment)

In addition, studies were included only if they were published in English.

The majority of studies were excluded during preliminary inspection. More than half of the search results did not appear in peer-reviewed journals (Criterion 1) and were immediately eliminated. Of the remaining articles, the majority were excluded because they did not pertain directly to PD of ECE teachers (Criterion 2). In the context of this article, *ECE* is defined as schooling for children ages 0 through 5, as around the age of 6 children often enter kindergarten and are more likely to be taught by a K–12 licensed teacher (Bowman, Donovan, & Burns, 2011; Snow, Burns, & Griffin, 1998).

Inclusion coding. A total of 101 articles remained after the initial inspection; 51 of these were excluded because they did not meet the criterion for rigorous empirical studies outlined previously (Criterion 3). For example, several qualitative studies did not include examples of data, only a brief description of the data analysis methods. Of the remaining 50 studies, some studies shared the same data, and these were examined to ensure that there was no double coding of information. Five studies shared the same data and reported similar outcomes, so only one study was included in this analysis. Two other studies shared data, but the focus of the research questions and the reporting of changes related to the PD were different across each study (different information was reported in the different types of studies), so both were included in the analysis. This resulted in the inclusion of a total of 46 studies. Similar to previous work (S. M. Wilson et al., 2001), secondary searches were conducted to look for references listed in the first round of studies and for papers of the major authors in the original search. This resulted in an additional 27 articles meeting

the rigorous inclusion criteria. Overall, 73 studies were included for review in this analysis. See **Table 1** for a summary of these studies.

Data Analysis

To address the research questions of this article, I examined the 73 remaining studies and coded them using a directed content analysis (Hsieh & Shannon, 2005). This process allows for researchers to examine texts or literature with a more narrowed focus, using predetermined coding categories based on the prior literature and research questions. Coding was designed to access information about the design, the implementation, and the evaluation of PD. Based on the review of the literature presented previously, main coding categories were created to address the questions about design, delivery, and measurement. This included coding for the use of theoretical resources and the instructional content targeted by the PD to capture design. Studies were also coded for their delivery method and whether this targeted teachers' skills, knowledge, and dispositions. Studies were then coded for their evaluation or measurement of the PD. The rationale and literature supporting these coding categories is described next.

Theoretical resources to support design. This category examined how researchers used theoretical resources, operationalized here as the citation of references within the study, to support their PD design decisions. This allowed insight into whether and how researchers were using previous work and which fields, ECE or K–12, they were citing. This was done in order to address questions about how theory informs PD (e.g., Dickinson et al., 2011; Wayne et al., 2008). References related to PD were first categorized as ECE or K–12. During the process of coding two additional subcategories of resources emerged based on whether researchers were using the citations specifically to support their PD design choices or using the citations in a vaguer manner. These subcategories helped illuminate how or whether the theoretical resources informed the PD design. A rate measure was calculated for each individual study. The rate was calculated by counting the total number of PD references and then dividing by the total number of PD references plus all other references.

Table 1. Key Characteristics of Included Professional Development (PD) Studies

Author(s)	Year published	Design of PD	Content	Targets: skills (S), knowledge (K), & dispositions (D)	Teachers
Intervention Studies					
Assel, Landry, Swank, & Gunnewig	2007	Training, coaching, and materials	Literacy	S, K	Head Start, *Universal Pre-k
Beardslee, Ayoub, Avery, Watts, & O'Carroll	2010	Training and coaching	Socio-emotional development	S, K, D	Head Start
Bierman, Nix, Greenberg, Blair, & Domitrovich	2008	Training, coaching, and materials	Literacy and socio-emotional development	S, K	Head Start
Breffni	2011	Coursework	General	S, K, D	Pre-k
Brendefur, Strother, Thiede, Lane, & Surges-Prokop	2012	Multiple trainings and materials	Math	S, K	Head Start
Brotman, Kingston, Bat-Chava, Caldwell, & Calzada	2008	Multiple training sessions	Socio-emotional development	S, K	Pre-k
Burchinal, Cryer, Clifford, & Howes	2002	Any type of PD experience	General	S	Any type of teacher
Buysse, Castro, & Peisner-Feinberg	2010	Training, coaching, and professional learning community	Literacy	S, K, D	Childcare
Cabell et al.	2011	Training and coaching	Literacy	S, K, D	Head Start & pre-k
Casey & McWilliam	2011	Training	Socio-emotional	S	*Childcare
Cassidy, Buell, Pugh-Hoese, & Russell	1995	Coursework	General	S, K	Childcare
Clements, Sarama, Spitler, Lange, & Wolfe	2011	Training, coaching, and materials	Math	S, K, D	*Pre-k
Debaryshe & Gorecki	2007	Training, coaching, and materials	Literacy and math	S, K	Head Start
DeWein & Miller	2009	Training and coaching	Socio-emotional development	S, K, D	*Childcare
Dickinson & Caswell	2007	Coursework	Literacy	S, K	Head Start
Domitrovich et al.	2009	Training, coaching, and materials	Literacy and socio-emotional development	S, K	Head Start
Downer, Kraft-Sayre, & Pianta	2009	Training, website, and online coaching	Literacy and socio-emotional development	S	Pre-k
Downer et al.	2011	Training, website, and online coaching	Literacy and socio-emotional development	S, K	*Pre-k

Author(s)	Year published	Design of PD	Content	Targets: skills (S), knowledge (K), & dispositions (D)	Teachers
Fox, Hemmeter, Snyder, Binder, & Clarke	2011	Training, coaching, and materials	Socio-emotional	S, K	*Childcare
Fukkink & Tavecchio	2010	Discussion of videos of practice	Socio-emotional development	S	Childcare
Gebbie, Ceglowski, Taylor, & Mills	2012	Online training and online professional learning community	Socio-emotional development	S, K, D	*Childcare
Gibson, Pennington, Stenhoff, & Hopper	2010	Web-mediated training	Socio-emotional development	S	*Childcare
Girolametto, Weitzman, & Greenberg	2004	Training and coaching	Socio-emotional development	S, K, D	Childcare
Gonzalez et al.	2011	Trainings and materials	Literacy	S, K	*Pre-k
Grace et al.	2008	Training, coaching, and materials	Literacy	S, K	Childcare
Green, Malsch, Kothari, Busse, & Brennan	2012	Multiple training sessions	Socio-emotional	S, K	Head Start
Gunter, Caldarella, Korth, & Young	2012	Training and materials	Socio-emotional	S	*Childcare
Hamre et al.	2012	Coursework	Literacy	S, K, D	Head Start and childcare
Heisner & Lederberg	2011	Coursework	General	S, K, D	Childcare
Harjusola-Webb & Robbins	2012	Coaching, meetings, and materials	Socio-emotional	S, K, D	*Childcare
Hemmeter, Snyder, Kinder, & Artman	2011	Training and coaching	Socio-emotional	S, K	Head Start and childcare
Jackson et al.	2006	Coursework and coaching	Literacy	S, K, D	*Childcare
Justice, Kaderavek, Fan, Sofka, & Hunt	2009	Multiple trainings and materials	Literacy	S	*Childcare
Justice et al.	2010	Trainings	Literacy	S, K	Childcare
Koh & Neuman	2009	Coursework and coaching	Literacy	S, K, D	Family childcare
Landry, Swank, Anthony, & Assel	2011	Online training and coaching and childcare	Literacy	S, K, D	Head Start, pre-k,
Landry, Swank, Smith, Assel, & Gunnewig	2006	Training and coaching	Literacy and socio-emotional development	S, K, D	Head Start

Author(s)	Year published	Design of PD	Content	Targets: skills (S), knowledge (K), & dispositions (D)	Teachers
Lonigan, Farver, Phillips, & Clancy-Menchetti	2011	Training, coaching, and materials	Literacy	S, K	Head Start, Title 1 pre-k
Massetti	2009	Training and materials	Literacy	S, K	Head Start
Mudd &Wolery	1987	Training and coaching	Socio-emotional	S, K	Head Start
Neuman & Cunningham	2009	Coursework and coaching	Literacy	S, K, D	Childcare
Neuman, Newman, & Dwyer	2011	Training and materials	Literacy	S	Head Start
Onchwari & Keengwe	2010	Training and coaching	Literacy	S, K, D	Head Start
Penuel et al.	2012	Training, coaching, and materials	Literacy	S	Childcare
Pianta, Mashburn, Downer, Hamre, & Justice	2008	Training, coaching, and materials	Literacy and socio-emotional development	S, K	Pre-k
Piasta et al.	2012	Training and coaching	Literacy	S, K, D	Childcare
Powell, Diamond, Burchinal, & Koehler	2010	Training and coaching	Literacy	S, K	Head Start
Raver et al.	2008	Training and coaching	Socio-emotional development	S, K, D	Head Start
Roehrig, Dubosarsky, Mason, Carlson, & Murphy	2011	Training and materials	Science	S, K, D	Head Start
Sibley & Sewell	2011	Training, coaching, professional learning community, and materials	Literacy	S, K, D	Head Start and pre-k
Slider, Noell, & Williams	2006	Materials	Socio-emotional	S, K	*Childcare
Snyder et al.	2011	Training, coaching, and materials	Socio-emotional	S, K, D	Head Start
Starkey, Klein, & Wakeley	2004	Multiple trainings and materials	Math	S, K	*Pre-k
Trivette, Raab, & Dunst	2012	Coaching	General	S, K, D	Head Start
Tschantz & Vail	2000	Coaching	Socio-emotional	S, K, D	Head Start
Varol, Farran, Bilbrey, Vorhaus, & Hofer	2012	Training, coaching, professional learning communities, and materials	Math	S, K, D	Head Start and pre-k
Vo, Sutherland, & Conroy	2012	Training, coaching, and materials	Socio-emotional	S, K, D	Head Start and *childcare
Wasik & Bond	2001	Training and materials	Literacy	S	*Childcare
Wasik, Bond, & Hindman	2006	Training, coaching, and materials	Literacy	S	Head Start

Author(s)	Year published	Design of PD	Content	Targets: skills (S), knowledge (K), & dispositions (D)	Teachers
Webster-Stratoon, Reid, & Hammond	2001	Multiple trainings	Socio-emotional development	S	Head Start
Yeh	2003	Materials	Literacy	S	Head Start
Yilmaz & McMullen	2010	Professional learning community	Literacy	S, K, D	Head Start
Yin et al.	2012	Training and materials	Health	S, K	Head Start
Process Studies					
Ackerman	2008	Professional learning community	General	S, K, D	Military
Diamond & Powell	2011	Training, website, and coaching	Literacy childcare	S, K, D	Head Start, pre-k,
Downer, Locasale-Crouch, Hamre, & Pianta	2009	Training, website, and online coaching development	Literacy and socio-emotional	S, K, D	re-k
Horm-Wingerd, Caruso, Gomes-Atwood, & Golas	1997	Training	General	S, K, D	Head Start
LoCasale-Crouch et al.	2011	Coursework	Literacy childcare	S, K, D	Head Start and
Neuman & Wright	2010	Coursework and coaching	Literacy	S, K, D	*Pre-k
Parette, Stoner, & Watts	2009	Multiple trainings	Literacy	S	*Childcare
Powell, Diamond, & Koehler	2010	Training, website, and online coaching	Literacy	S, K, D	Head Start
Powell, Steed, & Diamond	2010	Coursework and coaching	Literacy	S, K, D	Head Start
Wilson, Dykstra, Watson, Boyd, & Crais	2012	Training, coaching, and materials	Socio-emotional	S, K, D	*Childcare

* or Head Start label indicate that these studies worked with populations considered as "at-risk", categorized by low SES, English language learner, or special needs.

Instructional content targeted in the design. Content captured the subject area of the PD. Whereas other studies of PD have looked at specific content areas (e.g., Fukkink & Lont, 2007; Zaslow, Tout, Halle, Whittaker, & Lavelle, 2010), the purpose of this study was to be as inclusive as possible. In the majority of the studies the focus was directly stated (i.e., "a math intervention"), but in other cases this was categorized based on the study's description. Those studies whose content was not clearly identifiable or not specific to one or two content areas were coded as general.

PD delivery method. The format of the PD (e.g., training workshops or coaching) was coded based on the authors' description. This was done in order to examine how researchers are currently providing PD to ECE teachers. During the coding process a detailed description of the format of PD in each study was recorded. Although varying levels of detail were provided across studies, some patterns in formats emerged, and some models were grouped into categories based on similarities. Often similar terminology was used to define very disparate types of professional learning opportunities. For example, the broad term *training* was used to describe PD that could span from receiving 3 hr of instruction on emergent literacy and the use of curriculum materials (e.g., Massetti, 2009) to having a discussion about conducting effective home visits to families (e.g., Beardslee, Ayoub, Avery, Watts, & O'Carroll, 2010). For this reason, it was important to have another system for identifying or classifying different types of PD formats: specifically, an examination of how PD targeted skills, knowledge, and dispositions, explained next.

Skills, knowledge, and dispositions. The format of a PD model directly impacted whether the PD targeted teachers' skills, knowledge, and dispositions. Examining studies for how they targeted these areas was another way to differentiate the different designs of PD and was deemed essential given the significance in the ECE literature of developing all three of these aspects (Buysse et al., 2009; Fukkink & Lont, 2007; NAEYC, 1993; Sheridan et al., 2009; Snyder et al., 2011. Although these terms are often present in the ECE literature, they are rarely defined. Sheridan and colleagues (2009) described *skills* as units of action that occur in time and that are easily observable or

inferable; *knowledge* as facts, concepts, ideas, vocabulary, or under-standings of best practice; and *dispositions* as "tendencies to exhibit a pattern of behavior frequently, consciously, and voluntarily" (p. 380). These definitions were used in the coding process.

For the purposes of this study, these categories were seen as nest-ing within one another or building on one another. A skills-only PD focused solely on having teachers implement specific practices (e.g., Fukkink & Tavecchio's, 2010, training on implementing practices that improved teachers' interaction skills). Interventions that targeted teachers' knowledge were also considered to be targeting teachers' skills, as this is the underlying implicit if not explicit motive for pro-viding teachers with knowledge to alter their actions or practices in the classroom. A skills and knowledge training could be a format that provided training workshops to teachers providing developmental con-tent that supported the theories of a curriculum that teachers were asked to implement (e.g., Lonigan, Farver, Phillps, & Clancy-Menchetti, 2011). Trainings that targeted teachers' dispositions also targeted their skills and knowledge because in order to target teachers' dispositions PD must provide behaviors or skills for teachers to exhibit, but these build on new knowledge that teachers acquire. Then, there must be some lever for facilitating the voluntary aspect of impacting teachers' dispositions. An example of this might be a mentoring- based model in which teachers received training about a range of literacy practices but then worked individually with coaches in focused ways on prob-lems of literacy practice specific to that individual teacher and his or her classroom (e.g., Onchwari & Keengwe, 2010).

Evaluating change related to the PD. *Change* is used broadly here to capture any aspect of the PD that researchers chose to examine or the outcomes that they reported. Individual measures serve differ-ing purposes (National Research Council, 2008), and thus identify-ing how researchers measure change is important in understanding what researchers are reporting as effective about their PD. There was a wide range in the types of evaluation that the studies used, each examining something different related to the PD. This could include changes in teachers, children, or aspects of the classroom environ-ment. A variety of data were used, from measures created by the re-searchers for that particular study to standardized, psychometrically

tested assessments. These specific measures were coded and then grouped based on the targeted outcome. Several strategies were used for coding. First researcher description was used to classify the evaluation. Standardized measures could be researched and categorized based on the publisher's description. In the more ambiguous cases, decisions were made based on how the researcher used the measure. For example, a researcher-created protocol to code teachers' language (e.g., Girolametto, Weitzman, & Greenberg, 2004) was coded as a measure of practice, as it examined whether teachers used particular types of language related to the training.

Although some a priori categories developed from the literature review were used to guide the data analysis process, given the nature of the content analysis and qualitative coding, additional subcategories emerged during the analyses, as is often the case with this type of qualitative data analysis (Corbin & Strauss, 2008). These subcategories served as a means for further elaborating the main coding categories and addressing the research questions. For example, in the analyses addressing the third research question, subcategories related to whether a measure was standardized or created by the researchers emerged. These subcategories are reported in the Results section.

Results

This section describes the results of the data analysis based on the three research questions regarding the reported design, delivery, and evaluation of the PD.

Designing PD

The first research question examined how researchers reported the design of their PD. In the analysis of the literature, two categories of studies emerged: studies of the effectiveness of the implementation of the PD (n = 63) and studies of the process of implementing the PD (n = 10). The type of study directly impacted the information about design and implementation that was reported by researchers. In almost half of the implementation studies (n = 31), the term *intervention* was used to describe the actual act of implementing PD. A small

percentage of studies (13.7%, *n* = 10) self-identified as process studies, or specifically designed research focused on examining the organization and the implementation of the PD rather than examining the outcomes or results of the PD. The bulk of these studies reported on the rationale behind the design of the PD and teacher and trainer fidelity to the PD model. Studies not self-identifying as process studies were categorized as intervention studies because they assessed intervention outcomes, not outcomes related to the process, or specifically identified themselves as intervention studies.

Theoretical resources to support design. On average, 25% of the references in each study were specifically about PD; the other 75% of the references were often related to the rationale for targeting instruction in a particular content area or to broader information about ECE. The PD references drew more from the ECE literature (about 15% of all references), but they also drew from the K–12 literature (about 11%of all references). The majority of these PD references were process references used to aid in the conceptualization of the process of the PD (ECE = 7%, K–12 = 8%). **Table 2** reports means and standard deviations for the number of references related to PD used in the studies. The process studies, which were specifically about the development of a particular PD format, made more overall references to the previous PD literature (total = 41%, ECE = 25%, K–12 = 16%) than did the intervention studies (total = 21 %, ECE = 12%, K–12 = 9%), and the majority of the process studies' PD references were used to support the design of the PD process (ECE = 14%, K–12 = 12%).

Table 2. Mean (SD) Number of References to the PD Literature by Type of Reference

Reference	All studies	Intervention studies (n = 63)	Process studies (n = 10)
Total PD	12.68 (9.99)	11.63 (9.60)	19.30 (10.29)
ECE total	7.92 (7.42)	7.16 (7.19)	12.70 (7.39)
ECE process	4.29 (4.75)	3.81 (4.72)	7.30 (3.86)
ECE general	3.63 (4.03)	3.35 (3.94)	5.40 (4.33)
K–12 total	4.77 (5.29)	4.48 (5.44)	6.60 (3.92)
K–12 process	3.60 (3.91)	3.35 (4.01)	5.20 (2.86)
K–12 general	1.16 (1.94)	1.13 (1.93)	1.40 (2.07)

Note. PD = professional development; ECE = early childhood education.
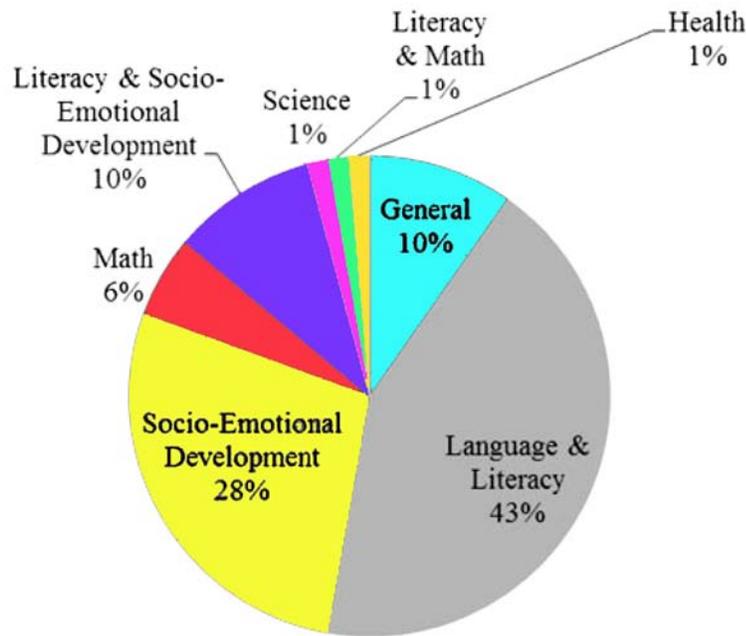
Figure 1. How studies targeted content of instruction.

Instructional content targeted in the design. The PD programs addressed several different content areas, sometimes focusing on a single content or multiple contents. **Figure 1** presents the distribution of targeted instructional content. The majority of the studies, 54% (*n* = 39), addressed some form of language and literacy instruction. The second most targeted content area was socioemotional development (*n* = 20). Seven studies targeted instruction generally. Only 6% (*n* = 4) of the studies focused on math instruction, and only one study targeted science. No studies addressed social studies–related instruction. The intervention studies addressed all eight content areas. The process studies, however, only targeted language and literacy instruction (*n* = 6), general content (*n* = 2), socioemotional development (*n* = 1), and literacy and socioemotional development (*n* = 1).

Delivery of PD

After providing their rationale for the choice of design or content to be targeted by the PD, researchers would then describe the delivery of their PD. The second research question addressed this delivery of PD. This section describes the reported delivery method as well as how this method targeted teachers' skills, knowledge, and dispositions.

PD delivery methods. In the 73 studies, there were 35 different PD delivery mechanisms. Common features of PD were the inclusion of coaching and the use of training workshops, which were implemented in more than half of the studies (coaching, n = 40; workshops, n = 45). About a third of the studies included implementing some form of curriculum as part of the PD (n = 26). Less common components of PD were coursework (n = 11) and online resources and/or coaching (n = 10). Very rarely did PD include the creation of professional learning communities (n = 3). Both intervention and process studies used this wide array of methods for PD delivery.

Skills, knowledge, and dispositions. The delivery or structure of the PD itself formed the basis for determining whether the PD targeted teachers' skills, knowledge, and dispositions. Studies only targeting teachers' skills were the least common at 19% (n = 14), with more studies targeting teachers' skills and knowledge (n = 23, 29%). The majority of studies, just more than half (n = 36), simultaneously targeted all three areas. Almost all of the process studies (n = 9/10) had PD formats that targeted teachers' skills, knowledge, and dispositions.

   Figure 2 presents a different representation of the way in which studies targeted skills, knowledge, and dispositions based on PD designs that used coaching. Coaching was the second most common
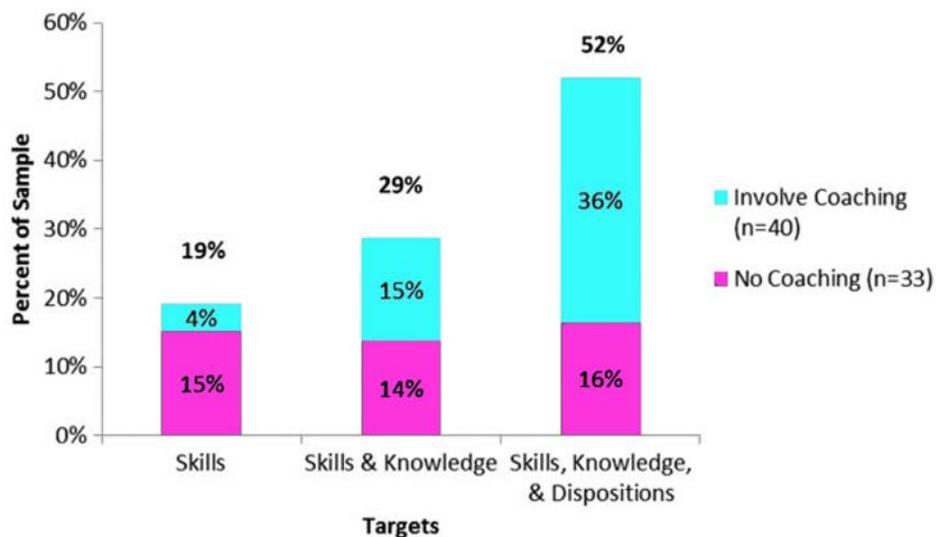

Figure 2. How studies targeted teachers' skills, knowledge, and dispositions.

component of PD, and it was used in more than half of the process studies (*n* = 6) and half of the intervention studies (*n* = 34). Moreover, its use has greatly increased over the past several years (see Table 1). Therefore, it is important to consider how coaching can be used to target teachers' skills, knowledge, and dispositions. As seen in Figure 2, coaching was used across all three categories, with the majority of these studies targeting skills, knowledge, and dispositions.

Evaluating PD

The third research question asked how researchers reported changes related to the implementation of the PD. Just as researchers targeted multiple content areas through the use of a variety of delivery mechanisms, there was a wide range in strategies used to assess changes related to the implementation of the PD. These results are presented in **Figure 3**. Findings showed that the most frequently measured feature of the PD was changes in teacher practice, which was accounted for in just more than half of the sample (*n* = 37). In more than 40%of these cases (*n* = 16), the tools used to observe changes in teacher practice were created by the researchers, and about 22% (*n* = 8) of these relied at least in part on teachers' self-report of changes in practice. Moreover, 25% (*n* = 18) of the sample reported changes in the classroom environment. Of the 18 studies that observed classroom environments, 83%(*n* = 15) used standardized, psychometrically tested
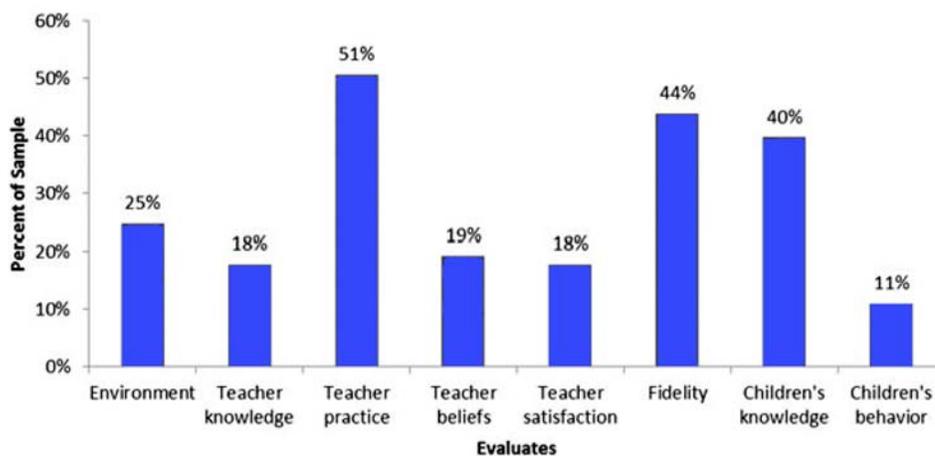
Figure 3. How studies reported evaluating change.

measures of the classroom literacy environment, such as the Early Language and Literacy Classroom Observation Tool (Smith & Dickinson, 2002), to track changes over time.

Fidelity was reported as a measure of success of the PD in 44% (n = 32) of studies, with the majority of these being coaching-related PD. In this context, *fidelity* means adherence to procedures of the PD—for example, whether the teacher implemented the practice correctly over time. Not all fidelity studies measures were used to examine teacher practice; sometimes fidelity was measured related to practices of coaches or the use of PD-related resources. Researchers reported fidelity as evidence that the procedures of the PD were followed, providing information about whether the PD occurred as it was designed. Fidelity was tracked by a variety of means, including teacher surveys, teacher interviews, researcher observation, Web log-ins (by both coaches and teachers), and fidelity checklists.

Less than half of the studies (49%, n = 36) reported changes in children's outcomes related to the implementation of the PD. None of the process studies reported changes in children's outcomes. Those intervention studies that did report child outcomes most often measured changes in children's knowledge or achievement, 40% of the overall sample (n = 29), with the majority using standardized measures to assess these changes. Five studies only reported outcomes from researcher-created measures versus other studies that used at least some standardized measures to report change. Only eight of the studies reported changes in children's behavior, accounting for 11% of the whole sample. All but one of these interventions targeted children's socioemotional development; the one remaining study targeted children's health.

Discussion

The preceding criteria-based review of the ECE research on PD identified trends in how researchers in the field are designing, delivering, and evaluating PD. This section discusses the implications of these trends for designing and implementing PD. Four major ways in which PD in ECE can be improved emerged from the data. These are (a) continuing to draw from multiple resources to inform PD implementation

designs, (b) including more diversity in the content of instruction targeted by PD, (c) experimenting with innovative formats for delivering PD, and (d) creating better means for evaluating PD.

Continuing to Draw From Multiple Resources to Inform the Design of PD

The majority of references cited in these studies were used to support researchers' decisions about the content targeted during the PD, not decisions about the structure of the PD. In general, researchers used references to explain the need to focus on specific content, particularly in the intervention studies. Only a quarter of the references in each study were related to PD, and even fewer of those references were in support of the PD design. Just as it is important to explain decisions about instruction for children, it should be equally important to explain decisions regarding instruction or professional learning for adults. More emphasis on how researchers selected or designed the methods of PD would help integrate adult learning theories into PD programs. This use of theory to inform the design of PD may illuminate methods for developing teachers' dispositions, which were only targeted in half of the studies in this analysis despite their importance in the ECE literature on PD (e.g., Buysee et al., 2009; NAEYC, 2009; Sheridan et al., 2009). Finally, increased focus on design choices could help identify which components of PD are successful. This is especially important as other researchers, such as Gupta and Daniels (2012), have noted that many PD interventions do not provide enough information either to understand why the PD works or to replicate the PD model.

When the studies used references to support the design of the PD, they looked across multiple research contexts, in both ECE and K–12, to inform their professional learning programs. Researchers used the existing ECE literature as well as broader theories of adult learning and the K–12 literature to develop their models of PD. Although there are unique challenges to providing PD in ECE and differences between teachers across the ECE and K–12 fields (Neuman & Kamil, 2010), these differences may not be as important or unique to ECE as previously believed, especially with the rising entry standards for ECE educators (Barnett, Carolan, Fitzgerald, & Squires, 2012). Moreover,

there is a rich body of knowledge in the K–12 and adult learning traditions that can help inform work with teachers of young children. In fact, the K–12 literature featured quite prominently in the process studies (e.g., Diamond & Powell, 2011; Downer, Locasale-Crouch, et al., 2009). assisting researchers in thinking about the elements of PD that contribute to long-term gains in teachers' learning. Continuing to use multiple sources to inform PD can only help broaden the ECE field's strategies for improving teachers' instruction and help strengthen work to improve outcomes for young children. Continuing to draw from multiple sources to inform PD may also help ECE researchers broaden their conceptions of classroom practice and theories about how to provide PD. This may be especially important in thinking about the role of contextual variables, such as the curriculum, in the work of teaching (e.g., Cohen, Raudenbush, & Ball, 2003; Lampert, 2001). Little is known about how characteristics of the curriculum, including programmatic curricula and orientations to children's learning, interact with the content of PD. Using K–12 frameworks (e.g., Grossman, Schoenfeld, & Lee, 2005; Shulman, 1987) may assist in understanding the relationship between context and professional learning, thus helping researchers ensure the success of PD.

This analysis found that many studies were able to take theoretical ideas about PD and use them to inform the practice of ECE teacher education in concrete ways. For example, several studies experimented with the length of the intervention and types of support provided to teachers. Continuing to look across the two literature bases may be especially important as designers and providers of PD in both fields struggle to operationalize and implement the often vague theories about professional learning (Wayne et al., 2008). A closer comparative examination of this research could provide insight into the notion that successful PD should be sustained and intensive (Garet, Porter, Desimone, Birman, & Yoon, 2001), answering questions about PD dosage and identifying which design features help make the PD sufficiently intensive for facilitating changes in teaching practice and children's outcomes. The studies included in this review provide concrete examples of how theory in action can serve as a resource for those designing future PD, in both the ECE and K–12 fields.

More Diversity in the Content of Instruction Targeted in PD

Whereas the majority of PD models included in this review focused on language and literacy instruction, less than 10% of studies examined how to improve teachers' math or science instruction, and no studies examined how to improve social studies–related instruction. In the past few years there has been an increase in PD targeting math and science instruction (e.g., Brendefur, Strother, Thiede, Lane, & Surges-Prokop, 2012; Clements, Sarama, Spitler, Lange, & Wolfe, 2011; Varol, Farran, Bilbrey, Vorhaus, & Hofer, 2012). However, the overall number of these studies remains relatively small compared to the research about PD targeting language and literacy instruction.

Perhaps this focus on improving language and literacy instruction is intentional. Given the research on the importance of children's language and literacy skills for not only reading but learning in other content areas (e.g., Snow et al., 1998; Storch & Whitehurst, 2002), researchers may target language and literacy instruction because high-quality instruction in these areas could bolster children's development of skills in other content areas. In fact, some assessments of early childhood content knowledge place more emphasis on teachers' knowledge of language and literacy development (e.g., Educational Testing Service, 2012), reinforcing this emphasis. Thus, the lack of balance in the content targeted in ECE may be purposeful, informed by the understanding that developing children's language and literacy will benefit other content areas.

Recent research, however, has found that when teachers engage children in science experiences they tend to use more complex language than in other areas, including book reading (Cabell, DeCoster, LoCasale-Crouch, Hamre, & Pianta, 2013). So, providing ECE teachers with PD in science may enhance children's science content knowledge as well as their language and literacy skills. Moreover, improving ECE teachers' math and science–related practices is receiving increased attention (e.g., NAEYC, 2009) and is especially important with the implementation of rigorous learning standards such as the Common Core State Standards (Common Core Standards Initiative, 2010) and the Head Start Child Development and Early Learning Framework (U.S. Department of Health and Human Services, 2010) that require children to start school with the basic foundations necessary to be

successful in multiple content areas. Targeting teachers' instruction in content areas such as science may be particularly important, as teachers often report having low efficacy and knowledge in these areas (Greenfield et al., 2009). There is a need for more investigations of how to help teachers improve their practice in content areas like math and science.

Experimenting With Innovative Formats for Delivering PD

One finding related to the delivery of PD was that only half of the studies in this review targeted teachers' skills, knowledge, and dispositions simultaneously. This pattern is concerning, as targeting these three areas is something that has been emphasized by the field as an important component of PD (e.g., Buysse et al., 2009; NAEYC, 2009; Sheridan et al., 2009). Although it may be easier in some cases to only target teachers' skills or ability to enact specific practices, not addressing teachers' knowledge and dispositions could be problematic. Narrowing PD to only consider specific skills or specific strategies for teaching those skills without consideration of the sustainability of these skills or how these skills relate to more general classroom practice hinders the long-term impact PD can or may have on teachers' practice. Chances to ensure real and sustained changes in practice may be lost when PD does not target teachers' dispositions.

Researchers reported the use of a wide range of PD formats in order to improve teachers' practice (35 different combinations of formats). Across the studies, there was a lack of specificity and consistency in the way in which researchers described their PD for teachers. Though the process studies (e.g., Powell, Steed, & Diamond, 2010; K. P. Wilson, Dykstra, Watson, Boyd, & Crais, 2012) were quite specific in how they implemented PD, providing a detailed model that could be used by other researchers, the intervention studies spent less time explaining how the PD was implemented. Moreover, researchers often used similar terms (e.g., *training* or *workshop*) to describe very different professional learning opportunities. Both the lack of specificity and the inconsistency in terminology makes it difficult to replicate the intervention or to determine what contributes to successful change in practice. These problems were especially prominent in the two most common delivery methods of PD, workshops and coaching.

Workshops. Despite the fact that there is a growing consensus that training workshops are not a very effective means of improving teachers' instruction and children's outcomes (Diamond, Justice, Siegler, & Snyder, 2013; Wayne et al., 2008), they still occurred in more than half of the studies in this analysis. Workshops are a ubiquitous and persistent component of teacher training, perhaps because of the various formats they can take and the low cost of implementation, particularly compared to more time-intensive models like individual coaching.

There does, however, seem to be a movement away from the workshop-only format for PD. Many of the studies in this analysis reported using workshops in addition to other PD elements. For example, Varol and colleagues (2012) reported that workshops were not enough to help teachers learn how to apply new knowledge and so only included workshops as one component of their PD model. It may be that workshops used in conjunction with other methods are assistive in facilitating teacher learning. Workshops as an orientation to curricular materials, workshops in which teachers meet their new coaches, or workshops providing training on how to use specific software are all instances of workshops that could be part of more elaborate PD models that assist in improving teachers' practice. Unfortunately, because workshops were used in a variety of ways across the studies, it would be difficult to pinpoint how training workshops are related to overall learning from PD, and more work is needed to understand appropriate uses for workshops in ECE PD.

Coaching. Coaching was another very popular method of PD, with the majority of the studies using coaching published in the past 7 years. This model, used in some form by almost half of the studies examined in this article, is one PD idea from the K–12 and adult learning literature (e.g., Garet et al., 2001; Joyce & Showers, 2002; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007) that has been carried over to and adapted for the ECE field. Although known by many different labels, this one-on-one work between a teacher and an experienced expert provides the opportunity for a much more intimate relationship that can allow for truly individualized teacher education and learning; this is often the rationale for why researchers have integrated this expensive and intensive feature into the design of PD.

Although this format seems to be growing in popularity, it is unclear whether coaching is actually causing long-term changes in teachers' practice or what it is about teachers' practice that changes. Some studies in this review that used coaching as part of the PD found effects for teachers and children (e.g., Powell, Diamond, Burchinal, & Koehler, 2010; Wasik, Bond, & Hindman, 2006). However, recently researchers (Hemmeter, Snyder, Kinder, & Artman, 2011; Powell & Diamond, 2011; Wasik & Hindman, 2011) have begun to critically examine issues of intensity and dosage in coaching and question what it is specifically about coaching that leads to changes in practice, focusing in particular on the relationships between coaches and teachers. These dosage and intensity issues are yet another example of the difficulty of translating theory into practice (Wayne et al., 2008) and may even suggest that the relationship between a coach and the teacher supersedes other components of the PD delivery model, including content.

Further clouding this issue is the wide variety in the way that coaching, like other forms of PD, was operationalized by the various studies. The roles of and interactions with coaches varied across studies. For example, one study (Assel, Landry, Swank, & Gunnewig, 2007) used coaching more as technical advising to help teachers successfully implement the curriculum in their classrooms, and the coaches only talked with teachers twice a month for a total of 3 hr. In contrast, the coaches in Neuman and Wright's (2010) PD visited individual teachers' classrooms to observe, model, and reflect on practice for about 3 hr every week for 10 weeks. This variety in implementation was also evident in the use of coaching in all three types of training: skills, knowledge, and dispositions focused. In skills-only training, coaching was solely used to ensure that teachers did the practice correctly. In a skills and knowledge intervention with coaching, teachers often learned the theoretical underpinnings of the content of the curriculum and the practices, and the coaching was focused on helping them use that knowledge to implement the curriculum. In skills, knowledge, and dispositions models, coaching interactions could be around a much broader range of practices and were highly dependent on the individual coach and teacher. Although coaching has the potential to affect more deep-seated changes in practice targeting teachers' skills, knowledge, and dispositions, not all models of coaching do this.

Moreover, it is unclear whether coaching leads to changes in practice and children's outcomes, as many of the coaching studies included did not report on child or teacher outcomes. Rather, evaluation of the success and implementation of the PD was related to fidelity of curriculum enactment (e.g., Assel et al., 2007) and/or the fidelity of coaches to the intervention model or content (e.g., Pianta, Mashburn, Downer, Hamre, & Justice, 2008 via weblogs). Although it is important to ensure that the PD model was followed and to understand what the coach has done, ultimately what matters is whether practice and outcomes differ. Only tracking coaches and their fidelity makes it difficult to know what changes teachers may have made to their practice and what specific impact coaching had on their knowledge, skills, and dispositions. In addition, little is known about the long-term impacts of coaching on teachers, especially when researchers are no longer present (Wayne et al., 2008).

The increasing use of coaching in the design and implementation of PD is problematic for other reasons as well. The feasibility of large-scale coaching models for PD is questionable, although Downer and colleagues (2011) did examine the efficacy of scaling up coaching models. However, coaching is very expensive and time consuming to implement (Wasik & Hindman, 2011), and there are often problems with finding and maintaining qualified coaches (S. Koh, personal communication, May 2011). The use of Web-based coaching models is one way to ameliorate some of these issues, and a growing number of researchers are exploring this format (e.g., Downer, Locasale-Crouch, Hamre, & Pianta, 2009; Powell, Diamond, & Koehler, 2010). More specified models of coaching, such as K. P. Wilson and colleagues' (2012) study, may remedy some of these concerns. Given these issues with coaching as a professional learning tool, the growing use of coaching as a design element of PD is a concern. The narrow focus on coaching may prevent researchers from exploring other formats and designs, particularly designs that are more feasible and less costly to implement. For example, PD through the development of professional learning communities that are mostly reliant on teachers to facilitate their own learning but can be implemented indefinitely once teachers are familiar with the process may be less expensive and more enduring (e.g., Ackerman, 2008; Yilmaz & McMullen, 2010).

Finally, as researchers explore innovative formats for professional learning, it is also important to consider the use of the word *intervention* as a way of conceptualizing PD. Rigorous intervention research conducted over the past two decades has played an important role in developing the empirical knowledge base around PD in ECE (Neuman & Kamil, 2010). Framing PD as an intervention, however, focuses researchers and teacher educators on the point of intervention or the mechanism for change rather than the entire teaching and classroom context. From this perspective researchers may lose sight of the fact that teaching takes place in a classroom in which many variables and nuances define and drive practice (e.g., Cohen et al., 2003; Lampert, 2001), including preexisting programmatic designs such as the curriculum. Instruction is not just a set of skills that exist in a vacuum (Grossman et al., 2005); the environment significantly influences teaching and teaching practice. None of this can really be accounted for in a one-size-fits-all PD. This may be particularly problematic in PD formats that depend heavily on curricula and materials as the means of intervention, represented in 25%of the studies included here and similarly represented in other reviews (e.g., Zaslow et al., 2010). Currently there is little understanding of how these contextual variables influence or interact with teachers' learning through PD and subsequent practice.

Creating Better Means for Evaluating PD

Evaluating PD is an important component of understanding the design and implementation of PD and is an important part of the empirical study of PD. Although the researchers in the studies examined here used a variety of means to evaluate PD, many of them, specifically the reporting of fidelity and environmental measures, do not provide complete pictures of the impact of PD. Only half of the studies reported outcomes related to teacher practice and children's learning, key indicators of PD efficacy (Gerde, Duke, Moses, Spybrook, & Shedd, 2014). If the goal of PD is to alter something about the teacher's instruction, then it seems necessary that actual changes in practice be measured. Moreover, although measuring child-related changes is often difficult and expensive, it is imperative if the field seeks to understand whether and how PD influences children's outcomes.

Many of the studies that did measure changes in practice relied on researcher-created tools or teachers' reports. These types of tools are assistive in learning specifics about implementation; however, they have limitations. These measures can be influenced by reporting biases on the part of teachers but also do not provide generalizable data for use outside of the specific project. Part of the problem with measuring changes in instruction is that until recently, there were not many tools available for examining teacher practice, and therefore researchers relied heavily on standardized measures of the environment as gauges of quality. When researchers use these structural measures to track the success of PD, as many in this review did, they may not really capture variation in practice, only variation in structures of the environment (Neuman & Kamil, 2010). Moreover, many of these measures focus on global classroom quality rather than the specific practices targeted in the intervention, making it difficult to track changes (Dickinson, 2006). Use of the Classroom Assessment Scoring System (CLASS; Pianta, La Paro, & Hamre, 2008), one standardized measure of practice, did appear in several of the later studies, particularly in studies initiated by the authors of the CLASS, who used the measure as a guideline for which teacher practices to target. And although it is one of the best tools currently available to researchers, it is important to note that this assessment can only capture instruction related to the language used by the teacher and is not applicable for analyzing instruction in specific content areas. The development of more standardized measures of practice is a crucial next step for those interested in investigating PD and the impacts of teacher learning on classroom instruction.

Based on these measures, not much is learned about long-term impacts of PD on teachers' practice. The interventions examined in this study were not designed for long-term implementation of particular skills or practices postintervention, so it is unclear whether teachers continue the newly developed practices. In fact, recent studies (Leiber et al., 2010; Sanford, DeRousie, & Bierman, 2012) have found that many preschool teachers do not continue to implement PD postintervention. They have found that this may be due in part to teachers' beliefs about the appropriateness of the curriculum for their children, another contextual variable not necessarily accounted for in current studies of PD. It also unclear what actual knowledge or

practices teachers take away from a PD and find useful over the long term in the classroom. These are areas for future research.

Although some researchers reported success in changing teachers' observable practice, it is difficult to know whether they were successful in changing teachers' underlying knowledge, which over the long term may contribute heavily to how teachers inform their instruction (Grossman et al., 2005). Measurement is a broader challenge for all those invested in teacher education, ECE and K–12, especially when it comes to looking at teacher practice and the complex way in which teachers combine knowledge and information to make choices in teaching (Shulman, 1987). Limited measures, or repeated use of one measure, can only provide insight into one area of change in teacher practice. When there are changes in teacher practice, experts do not, for the most part, know why they are effective. This is particularly true for intervention studies that do not report much detail about the PD process. Other researchers have also illuminated this problem, both in studies of specific PD methods (Gupta & Daniels, 2012) as well as in broader analyses of the PD literature (Synder et al., 2012).

Limitations of the Study

This analysis is intended to describe the state of PD research, and therefore it does not investigate or make assertions about the effects or impacts of the studies reviewed. Findings from this analysis do not indicate which PD models are more or less successful; rather, this analysis provides insight into recent trends in ECE PD. Because of the use of rigorous inclusion criteria, the number and types of studies that were included in this review were significantly limited. The studies analyzed in this article do not necessarily represent the larger corpus of published or reported work on PD in ECE that does not meet the criteria identified previously. It would be interesting to examine similar questions related to delivery and measurement with studies slightly less rigorous than the ones included in this review. Examining other reports or accounts of PD would perhaps demonstrate different patterns or trends in the broader context of PD for ECE teachers. However, the studies included in this article do represent the most rigorous work being done in the field, which starkly illuminates the measurement issues faced by ECE PD.

Future Directions

The results of this systematic review have provided directions for future research on and development of ECE PD. There is a need to focus on expanding the content targeted through PD as well as a need to develop better measurement tools for assessing the efficacy of PD. The field needs to continue to make connections across the ECE and K–12 literature in order to broaden both conceptions of teaching as well as models of PD, in particular to understand how context influences teachers' practice and learning. Finally, there is a need to consider innovative models of PD.

Based on these last two areas in need of development, one important future direction for this work is to use theories and delivery methods that conceptualize PD as a teacher-centered process rather than an intervention process. Teachers come to professional learning experiences with their own preexisting skills, knowledge, and dispositions (Buysse et al., 2009; Fukkink & Lont, 2007; NAEYC, 1993; Sheridan et al., 2009; Snyder et al., 2011). These resources are not necessarily theory driven; rather, teachers often rely more on common knowledge bases or knowledge they have gained from their own personal experiences to inform their classroom practice (Elbaz, 1983; Friesen & Butera, 2012; Hiebert, Gallimore, & Stigler, 2002). These inform their reasoning and decision making about teaching (Borko & Putnam, 1995; Shavelson, 1973). Using theories to inform the design and delivery of PD that recognize both the knowledge and experiences teachers already hold as well as their decision-making processes is crucial to improving instruction (Ball & Cohen, 1999). Chances to capitalize on these multiple sources of knowledge, however, are lost when they are not considered or built in to the design of PD. Moreover, not accounting for teachers' experiences as well as their connection to the instructional context (Cohen et al., 2003) may result in returning to business as usual once a PD intervention is over. Teachers need to have opportunities to improve their instruction in a generative way that builds on all of their sources of knowledge (Feiman-Nemser, 2001) and is relevant to their instructional context.

As those invested in improving teachers' practice and students' outcomes, we as researchers need to learn more about what teachers are thinking about during instruction and how this is related to the

instructional context. This type of focus would provide more information about what knowledge teachers use as they are in the act of teaching and thus provide a better baseline for conceptualizing and delivering targeted PD. Ultimately this type of approach would not only provide insight into why particular models of PD are effective but also lead to more long-term impacts on teachers' learning and children's outcomes.

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Appendix

Further Information About the Inclusion Criteria for S. M. Wilson, Floden, and Ferrini-Mundy's (2001) Review

In their review, S. M. Wilson, Floden, and Ferrini-Mundy (2001) outlined very specific criteria for what constituted empirical and rigorous research (p. 3). S. M. Wilson et al. only included articles that appeared in peer-reviewed journals; no book chapters, commissioned reports, dissertations, or meta-analyses were included. Empirical studies had to offer evidence that was "quantitative, qualitative, or both" (p. 13) to substantiate conclusions drawn

in the research, and only studies that described their methods and analyses were considered rigorous enough for inclusion. Furthermore, S. M. Wilson et al. developed specific inclusion criteria for different types of research methodologies often used to study teacher education, and they based these criteria on commonly held views of what constitutes "disciplined inquiry" (p. 13). Experimental and quasi-experimental designs required random assignment or matched characteristics for treatment and control groups. Regression studies and studies of credentialed versus noncredentialed teachers were only considered if they controlled for relevant differences between groups students or teachers. Similarly, longitudinal studies had to control for effects of attrition. S. M. Wilson et al. included qualitative studies, identifying them based on Erickson's (1986) description of qualitative methods and labeling them *interpretive studies*. These studies had to include evidence, such as participant responses or transcripts of events, to support assertions in order to be included; methods for data collection and analysis needed to be provided by authors.