Early Childhood Research Quarterly 50 (2020) 68–85

Contents lists available at ScienceDirect

Early Childhood Research Quarterly

Language intervention research in early childhood care and education: A systematic survey of the literature☆

Dale Walker[a,*], Samantha J. Sepulveda[a], Erika Hoff[b], Meredith L. Rowe[c], Ilene S. Schwartz[d], Philip S. Dale[e], Carla A. Peterson[f], Karen Diamond[g], Susan Goldin-Meadow[h], Susan C. Levine[i], Barbara H. Wasik[j], Diane M. Horm[k], Kathryn M. Bigelow[a]

[a] Juniper Gardens Children's Project, University of Kansas, United States
[b] Department of Psychology, Florida Atlantic University, United States
[c] Harvard University, Graduate School of Education, United States
[d] Haring Center for Inclusive Education, University of Washington, United States
[e] Department of Speech & Hearing Sciences, University of New Mexico, United States
[f] Department of Human Development and Family Studies, Iowa State University, United States
[g] Department of Human Development and Family Studies, Purdue University, United States
[h] Department of Psychology, Comparative Human Development, University of Chicago, United States
[i] Department of Psychology, Science of Learning Center, University of Chicago, United States
[j] Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, USA
[k] Department of Early Childhood Education, University of Oklahoma-Tulsa, United States

ARTICLE INFO

Article history:
Received 7 March 2018
Received in revised form 18 February 2019
Accepted 28 February 2019
Available online 16 April 2019

Keywords:
Language intervention
Early childhood
Poverty
Child care
Research

ABSTRACT

Children vary extensively in their language skills at school entry, and a substantial part of this variation is due to disparities in language exposure prior to school. Because these differences have continuing impact on academic, cognitive and social development, prevention and intervention programs have been developed to address deficits in early experience with language and prevent continuing difficulties. We report the findings from a systematic survey of research on non-parental interventions, with the goal of identifying strengths and weaknesses in current literature which can inform current practice and also guide the design of future research. Studies were identified using a systematic search protocol of the communication and language intervention literature for children from birth through 5 years of age. One hundred and ninety studies published between 1975 and 2015 met the specified inclusion criteria, which included the experimental manipulation of at least one relevant intervention variable and applying and testing an intervention or practice with the purpose of improving child communication or language outcomes. The studies reviewed include some well-documented and validated intervention strategies that have potential to be useful for addressing the word gap. This survey of the literature exposes gaps in the knowledge base about language interventions for infants and toddlers. Inadequacies in reporting the characteristics of child and adult study participants as well as a lack of details about the application of interventions across child care and early learning settings or their effectiveness with economically, culturally and linguistically diverse populations are addressed. Implications for the design and reporting of future research to address the word gap discussed.

© 2019 Elsevier Inc. All rights reserved.

☆ Preparation of this survey of the literature was supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under grant UA6MC 27762, Bridging the Word Gap Research Network (BWGRN) to the University of Kansas. This information or content and conclusions are those of the authors and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS, or the U.S. Government. Sincere appreciation is extended to: Melissa Kurrle and Emily Meyer for their work on the literature database, and to Shye Reynolds for software/web programming support. Appreciation is also extended to Dr. John Colombo for his suggestions on previous drafts of this manuscript. Additional support for this work was received from the Kansas Intellectual and Developmental Disabilities Research Center, NIH #U54HD090216, Schiefelbusch Institute for Life Span Studies, University of Kansas.

* Corresponding author at: Juniper Gardens Children's Project, Schiefelbusch Institute for Life Span Studies, University of Kansas, 444 Minnesota Ave. Suite 300, Kansas City, KS 66101, United States.
E-mail address: walkerd@ku.edu (D. Walker).

https://doi.org/10.1016/j.ecresq.2019.02.010
0885-2006/© 2019 Elsevier Inc. All rights reserved.

1. Introduction

The importance of environments that offer many and varied language-learning opportunities to infants and young children (e.g., Bakeman, Adamson, Brown, & Eldridge, 1989; Hoff-Ginsberg, 1985) was illuminated in early research conducted by Hart and Risely (1992, 1995). Their research described patterns of children's early language-learning stimulation and documented disparities in the quantity of child-directed talk and the quality of language interaction that children from different socioeconomic backgrounds experienced across their first three years of life (Hart & Risely, 1992, 1995). They estimated a gap in language-learning experiences between children from the most and least advantaged socioeconomic (SES) backgrounds that not only predicted children's vocabulary at age three (Hart & Risley, 1995, 2003), but predicted later delayed receptive and expressive language, spelling and reading performance in early elementary school (Walker, Greenwood, Hart, & Carta, 1994).

The early research conducted by Hart and Risley initiated an intensive professional discussion about the salience of early learning environments but has also generated critiques related to sample size and representation of children from minority backgrounds (e.g., Adair, Colegrove, & McManus, 2017; Baugh, 2017; Sperry, Sperry, & Miller, 2019). The robust association between socioeconomic status and quantity and quality of input has however been replicated since Hart and Risley's study (e.g., Hoff, 2003; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Pace, Luo, Hirsh-Pasek, & Golinkoff, 2017; Rowe, 2008, 2017; and see Golinkoff, Hoff, Rowe, Tamis-LeMonda, & Hirsh-Pasek, 2018 and the introduction to this issue Walker & Carta, 2020). Studies suggest that, for better or worse, children's earliest experiences with language greatly influence vocabulary development, reading skills and school performance (e.g., Burchinal et al., 2000; Catts, Fey, Zhang, & Tomblin, 2001; Dickinson & Porche, 2011; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Rodriguez & Tamis-LeMonda, 2011; Rowe, Raudenbush, & Goldin-Meadow, 2012). Deficits in language exposure in children's earliest years may have later social and economic costs (Heckman, 2006; Shonkoff & Phillips, 2000; Warren & Walker, 2005). Children who have limited language and literacy interactions may struggle to, or never, acquire reading fluency, social aptitude, or content knowledge needed for success in school (Burchinal, Roberts, Zeisel, Hennon, & Hooper, 2006; Catts, Bridges, Little, & Tomblin, 2008; Dickinson, Golinkoff, & Hirsh-Pasek, 2010). As such, they are more likely to experience future dependency, relative social isolation, and behavior problems (Goldstein, Kaczmarek, Pennington, & Shafer, 1992; Greenwood, Walker, & Utley, 2002; Qi & Kaiser, 2003).

Evident then, are the links between children's early language interaction with adults and their subsequent language, literacy, and social behavior (Aikens & Barbarin, 2008; Burchinal et al., 2011; Huttenlocher et al., 2010; Justice, Mashburn, Hamre, & Pianta, 2008; Landry, Smith, Miller-Loncar, & Swank, 1997). Links between adult–child language interaction and children's early neural connectivity have also been documented (e.g., Kuhl, 2010; Romeo et al., 2018). These associations underscore the importance of translating language intervention research into practice used by adults who provide intervention services to young children (Carta, Greenwood, Baggett, Buzhardt, & Walker, 2012).

1.1. Purpose for this survey

The purpose for this systematic survey was to document the state of the literature on communication and language interventions implemented by early educators and interventionists who have responsibility for the care and education of infants and young children. Understanding the features of interventions that may contribute to their success or failure in improving language outcomes, as well as the strengths and weaknesses of the research evidence is necessary to inform prevention and intervention efforts to build the capacity of adults to provide children with language-learning experiences that may address the word gap.

1.2. The impact of poverty on child language learning

The role of communication and language abilities in cognitive, educational, and social functioning is made clear when these abilities fail to develop due to impoverished language input, developmental delay, and/or combinations of risk factors such as poor nutrition and medical care (Shonkoff & Phillips, 2000; Warren & Walker, 2005). Children from socioeconomically disadvantaged or poverty backgrounds are at particular risk for developmental delays in language and other areas of development (ACF, 2015; NICHD Early Child Care Research Network, 2005; Yoshikawa, Aber, & Beardslee, 2012). For the nearly 6 million children (i.e., 1 in 5 children under age six) who are growing up in poverty, as well as for the 11.5 million young children from low-SES households, deleterious consequences for development are too often a reality (Child Trends, 2016; Centers for Disease Control & Prevention, 2018; Heckman, 2006). Differences in cognitive development have been documented for infants between 9 to 14 months of age experiencing poverty, compared to infants from advantaged homes (Halle et al., 2009; Rowe & Goldin-Meadow, 2009). Fernald, Marchman, and Weisleder (2013) found that by 18 and 24 months of age, the impact of poverty on children's language development was evident in both reduced vocabulary and language processing skills. When development is compromised by growing up in poverty, the consequences may lead to later learning delays, developmental and social-emotional deficits/disability and to what may be considered, a national public health problem (e.g., Carta et al., 2012; Heckman, 2008; Hoff, 2003; Mendelsohn et al., 2011; Shonkoff & Phillips, 2000).

1.3. Children with disabilities

Children with disabilities are vulnerable to the same environmental conditions known to impact language outcomes of their typically developing peers (Alexander & Entwisle, 1988; Rowe, Levine, Fisher, & Goldin-Meadow, 2009). Many children with disabilities may in fact, be in double jeopardy because of the compound and inter-related risk factors of poverty, minority, and disability status (Durkin et al., 2010; Mandell, Listerud, Levy, & Pinto-Martin, 2002; Tek & Landa, 2012). Delays in the acquisition of language milestones are often one of the first indicators that a child may have developmental problems (CDC, 2013; Dale, Price, Bishop, & Plomin, 2003). By kindergarten, most children receiving special education are referred for communication problems (Hebbeler & Gerlach-Downie, 2002; Wetherby & Prizant, 1993).

The research literature provides multiple examples of classroom-based interventions that are effective in facilitating the language growth of children with disabilities (Fleury & Schwartz, 2017; Hepting & Goldstein, 1996; Kaiser & Roberts, 2011; Schwartz, Thomas, McBride, & Sandall, 2013). However, access to high-quality, inclusive child care programs that provide individualized intervention and support needed to meet children's specific learning needs, has been limited (Buysse, 2011; Odom, Buysse, & Soukakou, 2011; Sandall & Schwartz, 2013).

1.4. Dual-language learners

The early learning experiences of one of the fastest growing segments of our society, children whose families speak a language other than English in the home, are not fully understood

(Espinosa et al., 2017). As with other minorities, children who are dual language learners (DLLs) disproportionately live in economically disadvantaged households (Centers for Disease Control & Prevention, 2018; Hoff, 2013). Although an increasing proportion of children attending child care are DLLs (Espinosa et al., 2017), they still represent a smaller number of children attending child care compared with other groups, with approximately 48% of Latino/a 4-year olds attending center-based care compared to nearly 70% of White and Black children. In their review, Hammer et al. (2014) reported that the amount of language exposure and usage by children who are DLLs plays a key role in promoting children's language development in one or more languages over time (Hammer et al., 2014). Importantly, Buysse, Peisner-Feinberg, Páez, Hammer, and Knowles (2014) reported that children made gains from attending early childhood programs with respect to language and literacy. Similar findings related to dosage and opportunities for practice for DLLs attending early learning programs were also reported by Yazejian, Bryant, Freel, Burchinal, and the Educare Learning Network (ELN) Investigative Team (2015).

1.5. Child care, early education and intervention

Over 12 million children (61% of children age 5 and under) spend some portion of their week in child care, early learning programs, preschool, or nonrelative care (Laughlin, 2013; U.S. Census). A number of notable, large-scale intervention projects (The Abecedarian Project – Campbell & Ramey, 1994; The Perry Preschool – Schweinhart, Barnes, & Weikart, 1993; Project CARE – Wasik, Ramey, Bryant, & Sparling, 1990) and longitudinal studies (e.g., Baby FACES – Aikens, Knas, Malone, Tarullo, & Harding, 2017; Clarke-Stewart, Gruber, & Fitzgerald, 1994; Cost, Quality and Child Outcomes Study – Peisner-Feinberg & Burchinal, 1997; Early Childhood Longitudinal Study-Birth Cohort – Halle et al., 2009; NICHD Early Child Care Research Network, 2000; Family Life Project – Vernon-Feagans, Bratsch-Hines, & the Family Life Project Key Investigators, 2013; Educare Implementation Study – Yazejian et al., 2015) have reported positive outcomes associated with the quality of child care for children from poverty backgrounds as well as ways to reduce the income-related achievement gap by providing interventions to increase school readiness and performance including language and literacy.

To identify those factors in early childhood programming most predictive of positive child outcomes, studies (Dowsett, Huston, Imes, & Gennetian, 2008; Howes, 1997; NICHD Early Child Care Research Network, 2004; Pelatti, Piasta, Justice, & O'Connell, 2014; Yazejian et al., 2015) have focused on structural variables (adult:child ratios, dosage, curriculum) while others (Burchinal et al., 2008; Justice, McGinty, Zucker, Cabell, & Piasta, 2013; Vernon-Feagans et al., 2013) have addressed process variables (caregiver–child interaction). Both are associated with caregiver responsivity and language stimulation (ACF, 2015; Zaslow et al., 2010).

There is substantial evidence for the buffering or protective effects of high-quality child care/early learning programs for children who experience poverty-related risks for social-emotional, language and academic outcomes (e.g., Burchinal et al., 2006; Campbell et al., 2012; Family Life Project Key Investigators, 2013; Vallotton et al., 2012; Yazejian et al., 2015). Considerable variability in quality exists, however, across child care programs (e.g., Phillips & Adams, 2001). This is a crucial issue because there is evidence suggesting that children who are at risk for poorer language and literacy benefit most from quality child care and early learning programs (Hindman & Wasik, 2013; Vernon-Feagans et al., 2013). However, children from low-SES backgrounds are less likely to access quality early childhood programs when they are infants or toddlers and therefore, may not receive an optimal dosage if they begin child care after their first or second year (Yazejian et al., 2015). Children who would most benefit from enriching language and literacy environments instead are more likely to be cared for in unlicensed programs with caregivers who may have less education, fewer resources or opportunities for professional development, or may experience inconsistent caregiving arrangements with relatives or friends (Justice et al., 2008; Love et al., 2012). Under these circumstances, it is more likely that children living in poverty will experience impoverished language stimulation during their earliest years (Burchinal et al., 2011; Markussen-Brown et al., 2017; Snow, Tabors, & Dickinson, 2001; Snyder et al., 2012).

1.6. Interventions to enhance language experience

Based on the transactional framework (Bronfenbrenner, 1994; Samaroff, 2000) that presumes that early communication development is facilitated by bidirectional, reciprocal and cumulative histories of interactions between a child and his/her environment, research on methods to enhance the communication and language development of young children has been conducted in homes and child care (Kong & Carta, 2013; Roberts & Kaiser, 2011; Warren & Walker, 2005; Zauche, Thul, Darcy Mahoney, & Stapel-Wax, 2016), with some of the earliest experiments conducted by Hart and Risley (1975, 1978). These, and other studies, have demonstrated that when the quality and quantity of caregiver–child interactions was improved, child language outcomes improved (Burchinal et al., 2008; Fontaine, Torre, Grafwallner, & Underhill, 2006; Hirsh-Pasek et al., 2015; Walker, Bigelow, & Harjusola-Webb, 2008).

1.6.1. Milieu and responsive teaching approaches

Naturalistic conversation-based models of language interventions include milieu and prelinguistic milieu teaching and responsive interaction models and associated strategies including, asking open-ended or "wh-questions asking "who?" "what?", commenting and labeling, prompting responses, inserting a brief time-delay, etc. (e.g., Goldstein et al., 1992; Harjusola-Webb & Robbins, 2012; Kaiser, Hancock, & Nietfeld, 2000; Peterson, Carta, & Greenwood, 2005; Tannock, Girolametto, & Siegel, 1992; Trent-Stainbrook, Kaiser, & Frey, 2007; Warren et al., 2008; Yoder & Stone, 2006). These intervention models provide the foundation for many of the intervention practices used with infants and young children with and without special needs (Dunst, Raab, & Trivette, 2012; Roberts & Kaiser, 2011).

1.6.2. Dialogic/shared book reading

Dialogic and shared book reading (Dale, Crain-Thoreson, Notari-Syverson, & Cole, 1996; Klass, Dreyer, & Mendelsohn, 2009; Lonigan & Whitehurst, 1998; Towson, Fettig, Fleury, & Abarca, 2017) is an evidence-based practice used to facilitate emergent literacy skills. In dialogic and shared book reading, an adult (e.g., teacher, parent) and child or a group of children, read a book together while the adult uses a variety of strategies including those described above to facilitate children's active involvement in practicing language during book reading (e.g., Wasik, Hindman, & Snell, 2016). Dialogic reading emphasizes the verbal interactions between the adult and child, prompting responses from the child, expanding upon the child's responses, and encouraging the child's participation in reading and practicing language (Fleury & Schwartz, 2017; Mol, Bus, de Jong, & Smeets, 2008).

1.6.3. The role of vocabulary

Vocabulary development is incremental, requiring repeated exposure and multiple interactions with words (e.g., Marulis & Neuman, 2010; Wasik et al., 2016). Children who are exposed to rich language-learning experiences have more opportunities to learn vocabulary and to practice using language than children who do

not have these experiences (Hart & Risley, 1995; Pan, Rowe, Singer, & Snow, 2005; Rodriguez & Tamis-LeMonda, 2011). Without opportunities to build their vocabulary, many children are not adequately prepared to benefit from the language and literacy instruction they will receive in school (Dickinson et al., 2010; Whitehurst & Lonigan, 1998). Thus, when children experience less than adequate vocabulary exposure in their earliest years, it is extremely difficult for them to make up for years of missed language-learning opportunities, and they may consequently never acquire average levels of reading fluency by 3rd gradeatts, Catts et al., 2008; Gilkerson et al., 2018; NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002; Walker et al., 1994). Preventive interventions translated from research to practice so they can be readily used at scale are needed to address this problem (Greenwood et al., 2017).

1.7. Aims and research questions addressed in this survey

The aim of this survey was to characterize the features of intervention studies focused on communication and language for infants and young children between birth and five years to identify strengths and weaknesses of current knowledge. As a first step, we describe the parameters of studies conducted to address language delay and promote communication and language to inform the design of future studies and contribute information needed for interventions to be translated into practice and taken to scale (e.g., Beeghly, 2006; Greenwood et al., 2017; Hassinger-Das, Hirsh-Pasek, & Golinkoff, 2017). To mitigate the word gap, an in-depth understanding of the features of current research is needed with attention to the characteristics of children and adults with whom intervention research has been conducted, the settings in which intervention practices are delivered, the methods used to deliver and test interventions, the extent to which fidelity of intervention implementation is measured, and outcomes attained (e.g., Dunst, Trivette, & Raab, 2013; Knoche, Sheridan, Edwards, & Osborn, 2010).

To identify the strengths and weaknesses in the literature on interventions and practices aimed at improving language outcomes for infants/young children, the Bridging the Word Gap Research Network (Carta, Greenwood, & Walker, 2014) convened interdisciplinary topical work groups to survey and summarize the extant literature on early language intervention. Here we report on a systematic survey of this intervention literature to document the "who," "what," "where," and "how" with respect to published language interventions delivered by non-parental caregivers, educators and therapists in child care/early learning and intervention settings.

The research questions addressed were:

1) What are the characteristics of the intervention studies conducted to increase children's communication and language in terms of study sample sizes, settings, child socioeconomic, cultural, ethnic, linguistic diversity, disability and/or risk status?
2) What are the characteristics of adults delivering interventions to young children in child care, early learning/intervention programs?
3) What interventions, strategies and procedures have been used to enhance the communication and language development of children?
4) What is the quality of the research evidence related to design, fidelity of intervention implementation, measurement and evidence of effectiveness of outcomes?

Based on the results from these research questions, we discuss strengths and weaknesses in the extant research literature to identify priorities for future research.

2. Methods

2.1. Search procedures

This research synthesis, conducted under the auspices of the Bridging the Word Gap Research Network (BWGRN) (blinded), is one of several included in this special issue undertaken to analyze the state of language intervention research conducted with infants and young children over the past 40 years. In this study, we analyzed the extant literature aimed at non-parental caregivers delivering intervention to infants and young children in child care, early learning and intervention programs to inform current and future intervention research.

2.1.1. Literature databases and search terminology

In this section, we describe the systematic review process employed to identify studies and assemble a database addressing language and communication interventions with infants and young children. The methods used to populate our core literature database were informed by Cooper, Hedges, and Valentine (2009) and Moher, Liberati, Tetzlaff, Altman, and the PRISMA Group (2009). We conducted a systematic electronic search of articles published between, Jan. 1975 through Mar. 2015 across electronic search databases including: PsychINFO, ERIC, MEDLINE, PubMED, ProQuest, EBSCOhost, Academic Search Complete, Web of Science and Google Scholar. Boolean operators and command searching language generated by the research team were used to link search terms and concepts. A number of search terminology strings were piloted with search terms added and subtracted and alternative truncation structures used. The following general search string delivered the most thorough results across the electronic search databases: (infant* OR toddler* OR preschool* OR child*) AND (language OR vocabulary OR communication OR Talk OR interact* OR word* OR gesture*) AND (interven* OR strateg* OR development) AND (parent* OR mother* or father* OR caregiver* OR teach* OR adult* OR "child care" OR childcare) AND (poverty OR "at risk" OR low-SES OR disab* OR bilingual OR DLL). This search string yielded 9766 articles. To ensure that the scope of relevant articles was identified, additional targeted searches using search terms defined by the BWGRN research team and work group members were also conducted yielding an additional 3048 articles for initial review.

2.1.2. Inclusionary and exclusionary criteria

To identify studies for inclusion in the BWGRN literature database, articles were then screened for relevance using the following inclusionary criteria: 1) published in peer-reviewed journal articles between Jan. 1975 through Mar. 2015; 2) conducted with children ages birth to 5 years; 3) focused on manipulating an independent variable, applying and testing an intervention and/or practice to improve child communication and/or language outcomes as a dependent variable. Studies that did not present empirical intervention research (e.g., conceptual or theoretical papers, descriptions of general practice, curricula, surveys, policy reports or presentations), publications included in books, chapters, reports; dissertations or theses; research reviews; case or clinical studies with one participant; studies conducted with children outside of the age range, and articles written in languages other than English were excluded. Following the removal of extraneous and duplicate articles, 1494 articles were retained (see Fig. 1, the Preferred Reporting Items for Systematic Reviews and Meta-Analysis; PRISMA Chart). Studies retained in the database were then subjected to a title, abstract and/or full-text review by research members to determine whether the study addressed the application of an intervention in which an independent variable(s) was included, or was descriptive and/or a prospective report. Following

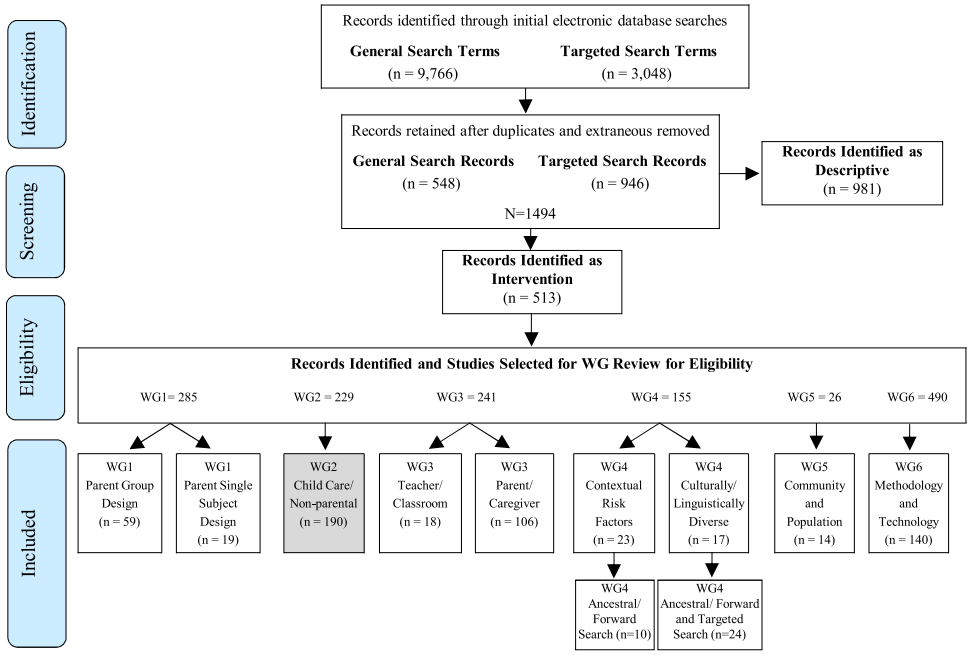

Fig. 1. Bridging the Word Gap Research Network core literature database. WG = Work group topic area addressed in research syntheses conducted by the Bridging the Word Gap Research Network.

this process, 513 articles from the BWGRN database qualified as being intervention studies and were retained (Fig. 1).

2.1.3. Database management

Citations and PDF copies of all the articles were stored in an online open-source reference management software database and application, Zotero (Center for History & New Media, 2006). The Zotero database web browser application permitted PDF copies of articles and associated metadata identified through the search process to be downloaded and stored for further review and analysis. Following application of the inclusionary/exclusionary criteria for the larger core database, studies retained in the collection were sorted and tagged using color codes for topical relevance for each BWGRN work group (e.g., Parent Interventions; Child Care, Non-Parental Interventions; Intervention Implementation; Risk Factors; Cultural and Linguistic Diversity; Community; and Methodology), stored and maintained in the Zotero database application to facilitate the coding process described below.

2.2. Coding procedures

A coding survey used for analyzing studies meeting the inclusionary criteria was developed using Qualtrics™, a web-based survey development software program. The BWGRN executive research team, with expertise in early childhood research and methodology, developed a 110-question survey to address issues relevant to communication and language intervention research. Informing the development of the survey were resources including the *What Works Clearinghouse Procedures and Standards Handbook* 3.0 (WWC Procedures and Standards, 2014), the *Division for Early Childhood Recommended Practices* (DEC-RP, 2014) (see Cook, Tankersley, & Landrum, 2009; Kratochwill et al., 2013; Odom et al., 2005; Snyder, 2006). Broadly, the coding survey questions included: citation information, purpose of the study, child and adult participant characteristics including cultural and linguistic diversity, disability and risk status, research design, numbers of participants and attrition, intervention type, length and procedures, measurement features – technical adequacy, fidelity of intervention, training and professional development, analytic approach, reported results, study limitations and implications. A copy of the coding survey is available in online supplementary material to this manuscript.

2.2.1. Coding certification and reliability

Prior to coding studies selected by each of the BWGRN work groups, research staff were trained and certified on the coding survey. Representative studies, two using group research methodology, and two employing single-subject research methodology were selected for this purpose. Members of the executive BWGRN research team reviewed and master-coded each study to establish the certification criteria for coders. To meet certification standards, coders were required to reach 85% or higher interrater agreement with each of two master coded studies. Once coders met the certification criteria, they were assigned studies from the core literature database that had been selected by each of the work groups to code using the BWGRN Coding Survey. A total of 494 studies were coded by a certified primary coder and reserved for analysis. From that group of studies, 190 studies published between Jan. 1980 through Mar. 2015 met the criteria for inclusion in the present survey (Fig. 1) (bibliography available in online associated Supplementary material).

2.2.2. Reliability

For the purposes of evaluating interrater agreement, 20% (99) of the coded studies from the larger core database were randomly selected and independently coded by a second certified coder from the research team. Agreement between the paired records was calculated using the formula: Percentage Agreement = [100 × (#matches/total questions)]. Overall average interrater agreement across coders for the 99 studies randomly selected (M = 92.4%). The average interrater reliability for individual questions was (M = 90.0%). For the present analysis, out of 190 studies selected, 24% (46) were coded for interrater agreement reliability. The average interrater agreement was (M = 93%).

2.2.3. Analytic procedures

General descriptive analytic procedures were used to examine the studies included in this survey of the literature. In these analyses, we report counts and percentages of studies broken down by critical sample, population, methodological, and intervention parameters addressed in the Bridging the Word Gap Literature Survey questions (see online Supplementary material to this article). Given the purpose of this survey of the literature, where possible, Chi-Square analyses were used to reflect comparisons across studies reporting the inclusion of children and families described as being from low-socioeconomic or poverty backgrounds (Low-SES/poverty subset). Studies included in this subset were those reporting annual income below a specified level or federal poverty guidelines and/or eligibility for federal subsidies or participation in state or federal programs or services for low-income, under-resourced families and children (i.e., Medicaid, Early Head Start; EHS, Head Start; HS, Women, Infants and Children Supplemental Nutrition Program; WIC, Free and Reduced Lunch-PL 111-296, Healthy Hunger-Free Kids Act) and are used in the following comparative analyses.

3. Results

Results are reported for the 190 studies that met the inclusionary criteria for an intervention study addressing communication and language conducted in child care, early education, and/or intervention programs by non-parental adults. Results highlight areas where the research literature provides information about the samples of children and families who have participated in intervention studies, the adults who have implemented or delivered the interventions (e.g., child care providers, early educators and interventionists), descriptions of the methodology used to evaluate the impact of interventions used to improve child communication and language outcomes that may have implications for interventions addressing children's early language-learning opportunities. Below, we report results regarding the description of the study sample, settings in which studies were conducted, and characteristics of child participants.

3.1. Study and child characteristics

3.1.1. Research Question 1

To address Research Question 1, study and child demographic characteristics including sample size, setting features, child age, gender, socioeconomic, cultural, ethnic, linguistic, disability and risk status of the children included are reported (see Table 1).

Table 1
Characteristics of child participants reported in studies.

Child participants	(n)	%
Sample size included in analyses ($N = 181$)		
<10	64	35
11–50	61	34
51–200	41	23
>200	15	8
Age of child participants ($N = 190$)		
Kindergarten (ages 5–6 years)	88	46
Preschool (ages 3–5 years)	143	75
Toddler (ages 12–35 months)	52	27
Infant (ages 0–11 months)	7	4
Gender ($N = 190$)		
Female	108	57
Male	135	71
Race/ethnicity ($N = 46$)		
White/Caucasian	32	70
Black/African American	25	54
Hispanic/Latino/a	19	41
Asian American/Pacific Islander	3	7
Diverse/unspecified	16	35
Did not report	144	76
Disability status ($N = 120$)		
Autism spectrum disorder	56	47
Unspecified developmental delay/disability	43	36
Speech/language impairments	38	32
Down syndrome	15	13
Other disability/delay	36	30
Not reported	70	37
Home language status ($N = 50$)		
Spanish	27	54
Not reported	140	74
Risk factors ($N = 190$)		
Low SES/poverty	66	35
Single parent home	18	9
Parent did not complete high school	13	7
Mental health issues	8	4
Parental substance abuse	6	3
Abuse/neglect	5	3
Low pre-academic skills/literacy	21	11
Not reported	107	56
Setting features		
Child care/early learning programs	135	71
Home setting	45	24
Clinical setting (research lab, health programs)	35	18
Community setting	3	2

Note. Categories may not total 100% as survey items and/or participant characteristics were not mutually exclusive.

3.1.2. Sample size and attrition

Overall, study sample sizes for the studies conducting interventions with infants and young children were small. The majority of studies reported included 10 or fewer child participants. Studies reporting sample sizes exceeding 200 were rare (see Table 1). Attrition levels were reported in 80% (n = 152) of the studies. While most studies reported no (zero) sample attrition, when reported, attrition was more common in the low-SES/poverty subset of studies compared to studies that did not include low-SES/poverty populations, $X^2(6) = 32.06$, $p < 0.001$.

3.1.3. Setting features

The settings or locations in which interventions delivered by non-parental early educators and interventionists were delivered to children and features of those settings varied across studies. As presented in Table 1, close to three quarters of the studies included in this survey reported taking place in child care, early education and/or intervention programs. These included publically and privately funded early childhood care and education programs as well as community-based and research clinics in which communication and language interventions were implemented to infants and young children. Just over a quarter of those studies, indicated that children with and without disabilities were included. Close to ten percent of the studies reported that the program in which the study was completed served children with disabilities specifically. For the low-SES/poverty study subset (n = 66) it was more likely that studies were conducted in child care or early learning programs (44) $X^2(1) = 15.46$, $p < 0.001$, compared to studies in the non-poverty sample. Children from lower-SES or poverty backgrounds were less likely to be included in studies conducted in healthcare or medical programs, speech and hearing clinics, or in research labs or clinical settings, $X^2(1) = 6.25$, $p < 0.05$. Differences by SES group were not detected for interventions delivered in homes by non-parental interventionists compared to other settings. Socioeconomic status of child participants was not reported for studies conducted in community settings (i.e., parks, libraries).

3.1.4. Age of child participants

Most of the studies reported including child participants who were preschool age or between 3 to 5 years old (36–59 months), while infants (0–11 months) were included in under 5% of the studies (see Table 1). All studies reporting inclusion of infants were found in the low-SES/poverty subset, $X^2(1) = 13.65$, $p < 0.001$. Studies of older children were represented in both the low-SES/poverty subset and the non-poverty subset.

3.1.5. Gender of child participants

Studies wherein investigators reported the gender of child participants indicated that males were included in almost three quarters of the studies whereas females were included in closer to half (see Table 1). In general, the proportion of female or male child participants was similar in the low-SES/poverty subset of studies compared to studies including non-poverty samples with no significant differences found for gender.

3.1.6. Race/ethnicity of child participants

Just under a quarter (n = 46) of the 190 studies reported information about the race or ethnicity of child participants. Reporting of race was more common in the studies included in the low-SES/poverty subset, $X^2(1) = 12.70$, $p < 0.001$. Of the studies reporting race or ethnicity of child participants, close to three quarters reported including children identified as White/Caucasian (see Table 1). Just over half of the studies reporting race indicated that Black/African American children were participants, while fewer than half reported that Hispanic/Latino/a children participated. In studies of low SES or poverty samples, Black, $X^2(1) = 10.47$, $p = 0.001$, and Hispanic, $X^2(1) = 10.09$, $p = 0.001$ children were however disproportionately represented, compared to White or other racial/ethnic groups. Children identified as Multiracial or from other racial backgrounds were not represented differentially across studies including low-SES/poverty samples, compared to non-poverty samples – although, with very few studies reporting race, caution in interpreting these results is advised.

3.1.7. Home language status

In terms of primary language spoken by the child and/or family, a little over a quarter of the total sample of studies (N = 190) reported including children whose primary home language was other than English (Dual Language Learners; DLL). Home language status however, was not specified or reported for over three quarters of the total studies included; as a result, caution should be used in interpreting these results.

In those studies reporting the DLL status of child participants, slightly over half indicated that Spanish was the participants' primary home language. Almost three quarters of the studies that reported including children who were DLL, were also included in the low-SES/poverty subset, $X^2(2) = 42.35$, $p < 0.001$. Therefore, a higher proportion of the studies in the low-SES/poverty subset reported including children who were DLLs. Further comparison of these samples indicated that it was also more likely that the language used to deliver the intervention differed from the child's reported home language in the low-SES/poverty subset (21%; n = 14), compared to no (zero) instances reported for the non-poverty sample, $X^2(1) = 28.39$, $p < 0.001$.

3.1.8. Special needs/disability status of child participants

Just over 60% of the studies reviewed included children with disabilities and/or delays as participants (see Table 1). The majority of those studies were in the non-poverty subgroup, $X^2(1) = 65.81$, $p < 0.001$.

Almost half of the studies that included children with disabilities reported including children with autism or autism spectrum disorder (ASD) but only one was included in the low-SES/poverty subset, $X^2(1) = 38.02$, $p < 0.001$. Studies including participants with a developmental disability, were however more likely to be included in the low-SES/poverty subset, $X^2(1) = 6.38$, $p < 0.05$. Further statistical differences by SES group were not detected for studies including children with speech/language delays, Down syndrome, or other disabilities.

Table 2
Characteristics of adult participants in studies.

Adult participants	(n)	%
Role of adult in study ($N = 190$)		
Delivered intervention	169	89
Recipients of training/professional development	85	45
Adult-directed intervention	31	16
Characteristics of adults ($N = 175$)		
Child care provider/early educator/paraprofessional	76	43
Research assistants/therapists	76	43
Parent(s)/guardian	54	31
Speech language pathologist/SLP assistants	26	15
Early interventionist/home visitor	15	9
Education level for early childhood/educators ($N = 22$)		
Associate's/bachelor's degree	7	32
Master's/doctoral degree	15	68
Not reported	54	71

Note. Categories may not total 100% as survey items were not mutually exclusive.

3.1.9. Risk factors experienced by child participants

Over 40% of the studies reviewed included children who experienced one or more risk factors (e.g., low-SES/poverty, low academic performance, teen or single parent, low parental education, parental depression) (see Table 1). Risk factors were, however, not identified or reported for almost 60% of the studies in the full sample of studies for this survey topic. Close to one third of the studies reported including children from low-SES or poverty backgrounds. Under 10% of the studies reviewed reported whether children lived in single-parent households; the majority of those studies were also included in the low-SES/poverty subset, $X^2(1) = 12.47$, $p < 0.001$. When studies reported parent education level, most included parents who either completed high school or an equivalent. However, the majority of the studies reporting that parents had not completed high school were included in the low-SES/poverty subset, $X^2(1) = 15.31$, $p < 0.001$. Reported parental mental health issues were also more prevalent in the low-SES/poverty subset of studies, compared to the studies in the non-poverty sample, $X^2(1) = 10.25$, $p = 0.001$. Similarly, parental substance abuse was reported as a risk factor in studies included in the low-SES/poverty subset, with none reported for the non-poverty sample, $X^2(1) = 11.64$, $p = 0.001$. Finally, just over 10% of studies identified children at-risk because of low pre-academic and/or literacy skills and over half of those studies were included in the low-SES/poverty subset of studies $X^2(1) = 5.22$, $p < 0.05$.

3.2. Characteristics of adult participants

3.2.1. Research Question 2

To address Research Question 2, we analyzed the characteristics of the adults who were the recipients and/or who delivered the interventions to young children in child care or through intervention programs. Adults who participated in the studies included child care providers, early educators, special educators, paraprofessionals, researchers and therapists, speech and language pathologists, as well as parents and guardians along with interventionists (Table 2). No statistically significant differences were detected between the characteristics of adults participating in studies by SES.

Table 3
Type of intervention or strategy used in studies.

Intervention/strategies	(n)	%
Type of intervention		
Intervention packages/combined strategies	145	76
Individual intervention strategies or components	45	24
Intervention		
Modeling	44	23
Dialogic/shared book reading	28	15
Milieu teaching	22	12
Targeted vocabulary	19	10
Verbal interaction	18	9
Expansion/recast	13	7
Responsive teaching	11	6
Time delay	11	6
Receptive and expressive language	5	3
Commenting and labeling	5	3
Other strategies		
Naturalistic	13	7
Prompting/guided practice	16	8
Token reinforcement	14	7
AAC devices	11	6

Note. N = 190. Categories may not total 100% as survey items were not mutually exclusive.

Table 4
Procedures used in delivery of interventions to children.

Intervention delivery procedures	(n)	%
Length of intervention		
Between 2- to 8 weeks	35	18
Between 2- to 8 months	67	35
9 months and more	30	16
Unclear or not reported	35	18
Duration of intervention sessions		
Between 30- to 120 min	110	58
No duration specified/free to vary	16	8
Duration varied by participant	18	9
Duration unclear	42	22
Method of intervention delivery to child		
Play-based	19	10
Discrete trial	13	7
Technology (computer, video)	16	8
Agent delivering intervention to child		
Teacher, early intervention provider, therapist	154	81
Parent delivered with intervention support	40	21
Sibling delivered with intervention support	7	4

Note. N = 190. Categories may not total 100% as survey items were not mutually exclusive.

Early education teachers, child care providers, therapists, and research assistants were reported as delivering the intervention(s) in the majority of the studies analyzed. Close to half of the studies reported that adults were the recipients of training or professional development in the intervention. Adults were the direct recipient of the intervention in just over 16% of the studies.

Out of the 76 studies that included teachers and early childhood personnel, most did not specify the level of adults' education ($n = 54$) (see Table 2). Across studies, no differences were found for level of adult education by SES. With so few studies reporting information about adults' education, caution in interpretation of results is recommended.

The distribution of studies in which early childhood personnel were reported to be White, Black, and/or Latino/a was similar across these racial/ethnic groups however, this information was reported for only 12% (n = 9) studies. Similarly, home language status of early childhood personnel was not reported in the majority of studies and therefore, caution is recommended when interpreting findings.

3.3. Intervention and/or strategies described

3.3.1. Research Question 3

To address research question 3, we analyzed studies to describe what interventions or strategies were used to enhance the communication and language development of children, in addition to the procedures used to deliver interventions. These results are presented in Tables 3 and 4.

In just over three quarters of the studies surveyed, investigators reported that an intervention package and/or a combination of strategies (i.e., dialogic, shared book reading, milieu or responsive teaching) was used to improve child language outcomes. In contrast, just under a quarter of the studies reported that one or more individual intervention components or strategies were evaluated (e.g., modeling, commenting, and labeling). Use of intervention packages or strategies varied as to whether or not the study included low-SES/poverty participants, $X^2(1) = 5.64$, $p < 0.05$, with a higher percentage, 86%, of the studies in the low-SES/poverty subset (n = 66) reporting evaluation of an intervention package. Individual strategies, components, or practices were instead more likely to be evaluated in studies including non-poverty samples, 29%, compared to 14% of studies in the low-SES/poverty subset.

As displayed in Table 3, modeling was the strategy most often reported to be used in the studies reviewed. Modeling was more often reported to be used as a strategy in studies in the non-poverty sample, compared to the low-SES/poverty subset of studies, $X^2(1) = 3.64$, $p = 0.05$. Dialogic/shared book reading intervention packages were reported to be used in close to 15% of the studies reviewed. The plurality (19) of those studies were included in the low-SES/poverty subset of studies, $X^2(1) = 15.89$, $p < 0.001$, compared to just (9) studies in the non-poverty sample. Targeted vocabulary interventions were reported for just about 10% of the studies reviewed. For targeted vocabulary interventions, differences were found between studies in the low-SES/poverty subset compared to those in the non-poverty group, with more vocabulary intervention studies reported for the low-SES/poverty subset of studies, $X^2(1) = 7.52$, $p < 0.01$.

Interventions described as using milieu or prelinguistic milieu teaching were reported in 12% of the studies. Studies evaluating milieu teaching interventions were less likely to report including children from lower-SES/poverty in their samples. Similarly, interventions characterized as verbal interaction strategies promoting communication exchanges were reported in just under 10% of the studies; the majority of which did not report including children from low-SES/poverty backgrounds. Differences by SES groups did not reach statistical significance.

Responsive teaching interventions and those described as increasing adult responsiveness were reported in just over 10% of studies reviewed (see Table 3). Statistically significant differences by SES group were not detected for this intervention package either. Strategies including expansions or recasting were reported in close to 7% of the studies reviewed. Labeling and commenting as well as time delay strategies, were used in a similar number of studies. Although not statistically significant, these strategies were reported to be used more often with non-poverty samples. Studies describing interventions focused on either receptive or expressive teaching strategies were reported in just a few of the studies reviewed. No differences by SES were detected for studies using receptive or expressive teaching techniques. Given the small numbers of studies analyzing these intervention strategies, caution in interpretation is advised.

3.3.2. Other strategies and interventions reported

Interventions described using terminology that differed from the coding categories for intervention studies were coded under

"Other" intervention techniques and grouped into general categories (e.g., naturalistic, prompting, guided practice, facilitation, token and/or reinforcement, direct instruction, phonological awareness) (see Table 3). Interventions and strategies listed were not mutually exclusive; as a result, more than one intervention package and/or strategy could be reported. The use of augmentative and alternative communication devices (AAC) was reported as an independent variable in 11 studies, none of which included studies in the low-SES/poverty subgroup, $X^2(1) = 6.21$, $p < 0.05$.

3.4. Intervention delivery procedures

3.4.1. Length of intervention

In Table 4, we report the range of the length of intervention delivery, as well as the duration of interventions and methods used to deliver interventions to child participants. The majority of studies reported interventions lasting between 2 and 8 months. Studies conducted for a shorter duration, ranging from 2 to 8 weeks were reported more often than studies in which the reported intervention length exceeded 9 months. Intervention length was not reported, or was unclear for almost 20% of studies reviewed. In our analyses, differences in study length/duration across time were noted for those studies including children from low-SES/poverty samples, compared to those that did not, with the longest studies reporting the inclusion of children in the low-SES/poverty subset, compared to studies in the non-poverty group (27.3%, 9.7%) respectively, $X^2(5) = 16.21$, $p < 0.01$.

The intended duration of intervention sessions reported in the majority of studies ranged from 30 to 120 min (see Table 4). Studies also reported daily or naturalistic intervention implementation with no specific time constraints while others reported variation in time by participant or treatment group. Duration of intervention sessions was not reported or was unclear in close to a quarter of the studies reviewed. Differences by SES group were not found.

3.4.2. Method of intervention delivery to child participants

Interventions were delivered using a variety of methods and agents (see Table 4). Play-based intervention delivery methods were reported in 10% of studies reviewed, the majority of which did not report including children from low-SES/poverty populations, $X^2(1) = 5.45$, $p < 0.05$. When used, discrete trial presentation format was reported mostly in those studies not in the low-SES/poverty subset (92% compared to 8%), $X^2(1) = 4.50$, $p < 0.05$. Technology and/or media was the reported means of intervention delivery in almost 10% of studies with no differences detected by SES group.

3.4.3. Intervention delivery agents

Teachers or other adults delivered the intervention in over 80 of the studies reviewed (see Table 4). Parents or other family members delivered the intervention in combination with, or with guidance or coaching from, an early educator, home visitor, or therapist in approximately 20% of studies reviewed (this category was not mutually exclusive, but instead permitted coding of multiple intervention-delivery agents). SES-related differences were not detected for studies wherein teachers, interventionists, or parents were reported to deliver the intervention. However, although siblings or peers were included in the delivery of interventions for under 5% of studies, when they were included, it was only in studies that did not report including children from low-SES/poverty backgrounds, $X^2(1) = 3.86$, $p < 0.05$.

3.4.4. Methods of intervention training for adult participants

Descriptions of the methods used to teach interventions and/or strategies were reported in 175 studies out of the full sample (N = 190). Coaching adults in the use of the intervention and/or performance feedback was the method of intervention delivery most often reported (Table 5). Group-delivered training or workshops were reported to be used in close to 30% of the studies, with modeling intervention practices reported in just under a quarter of the studies. Differences between SES groups by intervention format were detected in that almost twice as many of the studies in the low-SES/poverty subset used a group workshop format, compared to studies that did not include low-SES/poverty participants (41%; 24%), $X^2(1) = 4.96$, $p < 0.05$.

Table 5
Intervention delivery procedures to adults.

Intervention delivery procedures to adults ($N = 175$)	(n)	%
Coaching/performance feedback	49	28
Modeling	43	25
Group training/workshops	52	30
Technology/media	23	13
Manuals	35	20

Technology or media use in the delivery of intervention was reported in just over 20 studies, with no differences found for SES group (see Table 5). Differences were, however, found for the studies reporting to use manuals or written material in the delivery of training to adults, with 31% of the studies included in the low-SES/poverty subset reporting using manuals or written materials to deliver content, compared to approximately 15% of the studies that did not include low-SES/poverty participants, $X^2(1) = 6.00$, $p < 0.01$. Information regarding the modality of intervention delivery was reported in just over half of the studies. Omission of information about intervention delivery was most prevalent in studies that did not include low-SES/poverty samples (80% compared to 24%), $X^2(1) = 6.27$, $p < 0.01$.

3.5. Standards of evidence supporting intervention

To address Research Question 4, we analyzed the quality of the research evidence of the studies surveyed. First, we summarize the results from our analysis of the research design methodology used across the studies. Design standards for group and single subject studies were aligned with those reported in the *What Works Clearinghouse Procedures and Standards Handbook* (WWC PSH, 2014) and with recommendations outlined in the *Division for Early Childhood Recommended Practices* (DEC RP, 2014). Given the importance of the measurement of intervention implementation fidelity to child outcomes and replication of studies (Knoche et al., 2010; Wolery, 2011), we report the extent to which fidelity of intervention implementation was measured. Information regarding the measurement of child and adult outcomes, documentation of psychometric features, as well as intervention effectiveness are reported.

3.5.1. Study research design and analytic methods

Research design and analytic methods were characterized for each study in the full data set (N = 190). The vast majority (92%, n = 174) of studies used quantitative analytic methods; the remainder (8%, n = 16) reported using qualitative or mixed methods. As illustrated in Table 6, randomized experimental and single subject designs were both commonly reported. Quasi-experimental designs were reported in just over 20% of the studies. Intervention-only designs were used in under 15% of the studies.

The type of research design varied significantly as a function of whether or not the sample included low-SES/poverty participants, $X^2(4) = 20.26$, $p < 0.001$. Randomized and quasi-experimental designs were reported in studies including participants from low-SES/poverty backgrounds (44% and 29%) more often than in studies that did not include low-SES/poverty samples (29% and 16%). Single subject designs were more likely to be used in studies

Table 6
Research design and analytic methods used in studies.

Research design and analytic methods	(n)	%
Research designs used (N = 190)		
Randomized control treatment design	65	34
Quasi-experimental designs	39	21
Intervention-only designs	27	14
Single-subject designs*	58	31
Multiple baseline	35	60
Multi-element, changing-criterion, parallel treatments	17	29
Reversal designs	6	10

Note. *Type of single-subject design, n = 58. Categories may not total 100% as survey items were not mutually exclusive.

Table 7
Intervention fidelity methods.

Intervention fidelity	(n)	%
Strength of methods		
Measurement of fidelity reported	89	47
Moderate to strong measurement procedures	69	78
Weak or inadequate measurement procedures	20	23
Techniques used to measure fidelity		
Direct observation	38	43
Checklists/rating scales	36	40
Video recording	33	37
Description using a log recording	11	12

Note. N = 89. Categories may not total 100% as survey items were not mutually exclusive.

featuring non-poverty samples (41%) than in studies including low-SES/poverty backgrounds (11%).

3.6. Group study design

3.6.1. Nature of control groups and tests of pretreatment equivalence

Of the studies using randomized or quasi-experimental designs (n = 104), no-treatment/business-as-usual controls were reported in 56% (n = 58) of studies. Studies including comparison groups with a specified treatment control were reported for 59% of studies (note that these categories were not mutually exclusive). No-treatment/business as usual controls were more often reported in studies featuring participants from the low-SES/poverty subset, $X^2(1) = 8.20$, $p < 0.01$, with 59% (n = 34) of those studies reporting using no treatment/business-as-usual controls, compared to only 41% (n = 24) of the non-poverty sample studies. In studies of non-poverty samples, 64% (n = 39) used a comparison group with a specified treatment; this type of control was used in only 36% (n = 22) of studies of low-SES/poverty samples, $X^2(1) = 6.04$, $p < 0.05$.

In this same group of 104 studies using randomized or quasi-experimental design, group equivalence prior to treatment onset was reported to have been established on at least one variable (e.g., parent education, child expressive language ability, etc.) in 66% (n = 69) of studies. Establishment of group equivalence prior to treatment onset did not differ as a function of the low-SES/poverty status of the sample.

3.7. Single subject design

The most commonly reported single-subject design used to analyze results was a multiple baseline design (see Table 6). Reversal and alternating treatment designs were reported in approximately 20% of the single-subject studies. Additional single-subject designs reported by investigators included multi-element, changing-criterion or parallel treatment designs; comprising over a quarter of the single-subject study designs reported.

Most of the studies (71%; n = 41) using single-subject methodology reported that the baseline condition was controlled or adapted. In 24% (n = 14) of the single-subject studies, baseline was described as business as usual. Differences by SES group were not detected in analyses of baseline conditions for single-subject studies.

3.7.1. Methodological design standards for single-subject studies

Twenty-two percent (n = 13) of the single-subject studies reviewed met single-case research design standards "Without Reservation," using the standards outlined by Kratochwill et al. (2013). Specifically, studies meeting the highest level of design standard were studies reporting: 3 attempts to demonstrate an intervention effect with at least 5 data points in each condition phase, measurement of interobserver agreement for at least 20% of data collected, and mean interobserver agreement across condition phases of at least 0.8–0.6 for Kappa. Approximately 38% (n = 22) of studies met design standards "With Reservation." Close to 35% (n = 20) of studies appeared to not meet adequate research design standards with insufficient information provided for 5% (n = 3) of the studies. Differences reaching statistical significance were not found for studies included in the low-SES/poverty subset compared to the non-poverty group in terms of meeting recommended research design standards. In analyses of design standards across specific intervention packages or strategies we did not detect statistically significant differences.

3.8. Fidelity of intervention

Intervention fidelity was reported in almost half of the 190 studies surveyed and results are summarized in Table 7. Of those studies reporting the measurement of intervention fidelity, over three quarters reported strong to moderate measurement of intervention fidelity, defined generally as providing detailed description of frequently measured adherence or implementation of the intervention evaluated, including a plan for rectifying inaccurate implementation. For just under a quarter of the studies reporting fidelity, measures were determined to be weak or inadequate (e.g., description as to how it was measured, frequency, and/or utility of measurement not rigorous) (see copy of Coding Survey in online Supplementary materials).

Techniques used to measure intervention fidelity included direct observation, checklists, and/or rating scales, video recording, and logs. The number and percentage of studies reporting use of each method are provided in Table 7. Studies reported using all methods, with logs used least frequently. The mean level of intervention fidelity was reported in 89 studies in which fidelity was measured, with 48% (n = 43) reporting that the mean fidelity was high throughout the study (e.g., equal to or greater than 85%). Investigators in seven studies reported that the mean fidelity level was adequate throughout their study with scores between 70 and 84%. For most of the studies, 92% (n = 82), barriers to measuring intervention fidelity were not discussed. Statistical differences by SES subgroup for intervention fidelity were not detected.

3.9. Measurement of child outcomes

Measurement of child language outcomes was reported in 96% (n = 182) of the studies reviewed. Approximately half of those studies reported using standardized or norm-referenced measures to assess child language outcomes. The largest proportion, 67% of studies reporting to use standardized norm-referenced measures, were from the low-SES/poverty subset of studies, $X^2(1) = 11.66$, $p < 0.001$.

Author-created outcome measures (measures developed by the investigators) were used in just over 40% of studies (Table 8). Language samples (direct observations) were reported in a simi-

Table 8
Measurement of child outcomes.

Measurement of child outcomes	(n)	%
Methods (N = 182)		
Standardized or norm-referenced measures	91	50
Author-created measures	79	43
Curriculum- or criterion-based measures	28	15
Standardized non-normed measures	16	9
Progress monitoring measures	7	4
Intervention provider/parent report	7	4
Reliability and validity measurement (N = 186)		
Reliability measurement some/all measures	67	36
Validity measurement some/all measures	35	19
Direct observation measures	67	37
Automated observation measure (audio, video, computer)	50	26
Non-automated observation measures	22	12
Author-created observational measures	21	11
Reliability measurement of observation measures (N = 93)		
Trained to specified criteria	65	70
Observer interrater-reliability	71	76

Note. Categories may not total 100% as survey items were not mutually exclusive.

lar number of studies (n = 67). Language sampling measures were, however, more often reported in studies that did not include children from low-SES/poverty backgrounds, with 79% (n = 53) of studies reporting to use language sampling techniques, compared to only 21% (n = 14) of studies in the low-SES/poverty subset, $X^2(1) = 9.47$, $p < 0.01$.

Curriculum- or criterion-based measures, un-normed standardized measures, progress monitoring measures, as well as self-report measures, were used to document child outcomes in many of the studies (see Table 8). SES group differences by measure were not detected.

3.9.1. Psychometric properties of measures

Psychometric information or descriptions of technical adequacy (e.g., reliability, validity) were reported for some, or all, measures for 38% (n = 72) of the studies reviewed in the full sample. Reliability evidence for some, or all, measures were reported in just over 35% of studies, and validity information was reported in just under 20% of studies. No differences were found between levels of psychometric information reported for the full sample, compared to that reported in the low-SES/poverty subset of studies.

3.9.2. Observational measures

The use of automated observation measures (i.e., audio- or video- recordings) were reported in slightly over a quarter of the studies reviewed (Table 8). Of those studies reporting the use of automated measures, fewer were conducted with samples that included children from low-SES/poverty backgrounds, $X^2(1) = 6.50$, $p = 0.01$. As noted in Table 8, non-automated observational measures of child outcomes were reported in just over 10% of the studies reviewed with no differences detected between studies including children from low-SES/poverty backgrounds compared to those that did not. Authors reported using researcher-created observational measures in just over 10% of studies reviewed; only a small number of those studies included children from low-SES/poverty backgrounds, $X^2(1) = 6.60$, $p < 0.01$.

3.9.3. Reliability measurement of observation measures

A majority of studies using observational measures reported that assessors were trained to some specified criteria (see Table 8). Observer interrater reliability on observation measures was reported for over three quarters of the studies, with 94% (67) of those studies reporting Kappa scores between 0.6–0.8. In approximately 77% (n = 55) of the studies reporting reliability, authors stipulated that reliability was measured for at least 20% of sessions across all experimental conditions. Measurement of reliability at this level was found to be more frequent for studies including non-poverty samples (83%) than for those including poverty samples (59%), $X^2(1) = 4.44$, $p < 0.05$. Assessors were partially or fully naïve to the experimental condition in only 26% (n = 50) of studies reviewed.

Table 9
Child outcome areas measured.

Child outcomes measured	(n)	%
Expressive language	119	65
Receptive language	84	46
Literacy skills	47	26
Social communication	47	26
Child aptitude/school readiness	28	15
Social-emotional development	18	9
Use of sign language or AAC	9	5

3.9.4. Treatment of missing data

In just over half (51%; n = 97) of the total sample of studies reviewed (N = 190), no missing data were reported, or data sets were reported to be complete. It was far more common to have complete data in the non-poverty samples, compared to studies that included children from low-SES/poverty backgrounds (83% compared to 18%). Because missing data were more common in studies including children from low-SES/poverty backgrounds, exclusion of missing data and imputation were more common for the studies in the low-SES/poverty subset, $X^2(2) = 28.91$, $p < 0.001$.

3.10. Intervention outcomes

Outcome areas measured for child participants included expressive and receptive language or vocabulary (Table 9). While SES-related differences were not found in the number of studies measuring expressive language, measurement of receptive language was more often reported in studies included in the low-SES/poverty subset, compared to the non-poverty sample (63% versus 37%), $X^2(1) = 10.61$, $p < 0.001$. Studies reporting measurement of literacy outcomes were more prevalent as well in the low-SES/poverty subset of studies (48%; 14%), $X^2(1) = 26.35$, $p < 0.001$. For studies measuring social communication outcomes, the opposite pattern was seen, with a higher proportion conducted with children who were not reported to be from low-SES/poverty backgrounds (34% compared to 11%), $X^2(1) = 11.42$, $p < 0.001$.

In addition to language outcomes, studies also reported measuring social-emotional development as well as child aptitude and/or school readiness (see Table 9). Differences across SES groups were not found for the number of studies measuring either of those child outcomes. Although reported less frequently, when outcomes related to the use of sign language or AAC devices were reported, none included children from low-SES/poverty backgrounds, $X^2(1) = 5.13$, $p < 0.5$. Measurement of outcomes related to joint attention and conversational turns were reported in fewer than 2% of the studies, with no differences found across SES groups.

3.11. Analytic strategies used to report outcomes

The primary data analytic strategies used to analyze data in the studies reviewed included graphical display, analysis of variance or covariance (ANCOVA), descriptive statistics, multivariate analysis of variance or covariance (MANCOVA), multi-level modeling and/or hierarchical linear modeling, and multiple regression (Table 10). Differences in analytic strategies employed in studies represented in the low-SES/poverty subset, compared to studies that did not include children from low-SES/poverty backgrounds, were found for use of graphical display (23% for the low-SES/poverty subgroup, compared to 77% of the non-poverty group), $X^2(1) = 9.12$, $p < 0.01$.

Table 10
Analytic strategies used to report study outcomes.

Analytic strategies used to report outcomes	(n)	%
Graphical display	83	44
Analysis of variance/covariance	62	32
Descriptive statistics	60	31
Multivariate analysis of variance/covariance	18	9
Multi-level modeling techniques	18	9
Multiple regression	11	6

Note. Categories may not total 100% as survey items were not mutually exclusive.

Analysis of variance (ANCOVA) techniques were reported to be used in studies including children in the low-SES/poverty subset to a greater extent than in the non-poverty studies (50% compared to 23%), $X^2(1) = 13.87$, $p < 0.001$. Although multivariate analysis of variance (MANCOVA) strategies were used less frequently, they were reported to be used more often in studies included in the low-SES/poverty subset, 17% (n = 11), compared to the non-poverty group, 6% (n = 7), $X^2(1) = 6.10$, $p < 0.5$.

3.11.1. Studies reporting effect sizes

Analysis of effect size for outcomes was reported for 32% (n = 60) of studies out of the total sample of studies surveyed. Proportionally, effect size was reported more frequently in studies included in the low-SES/poverty sample, 47%, compared to just 23% of the studies in the non-poverty sample, $X^2(1) = 11.08$, $p = 0.001$.

Effect size reporting was also differentiated by study research design methodology, $X^2(1) = 18.59$, $p < 0.001$. Studies using randomized-control group designs (n = 65) were more likely to report effect size statistics (55%) than studies using other research designs (e.g., quasi-experimental, single subject, or intervention-only) (33%; 9%; 22% respectively).

Chi-square analyses were conducted to document the degree to which investigators reported effect sizes across interventions. When Dialogic/shared book reading interventions were analyzed (n = 28), there was a higher probability that effect size statistics would be reported, 61% (n = 17), compared to 39% (11) in which effect size analyses were not reported, $X^2(1) = 12.90$, $p < 0.001$. Similarly, when vocabulary interventions were reported (n = 19), it was also more likely that effect size statistics were reported, 68% (13), compared to 32% (n = 6) studies in which effect sizes were not reported, $X^2(1) = 13.26$, $p < 0.001$. In contrast, studies investigating verbal interaction (n = 18) were less likely to report effect size statistics, 94%, $X^2(1) = 6.23$, $p < 0.05$.

Across the studies reviewed, 96% (n = 183) reported that the intervention/strategies evaluated were successful in achieving the stated purpose for all or some groups and outcomes. In only 4 studies, did authors report that the intervention failed to achieve its stated purpose.

3.12. Social validity/acceptance reported

Analysis of the acceptability or social validity of the intervention was only reported in 13% (n = 24) of the studies included in the full sample (N = 190). Of those studies reporting information about the acceptance or social validity of the intervention studied, 63% (n = 15) reported high levels of acceptance with the intervention by recipients and participants (e.g., parents, teachers, interventionists). Moderate acceptance levels were reported for 21% of studies. No differences for social validity were found by SES group. Given the small number of studies reporting social validity overall, caution is recommended in interpreting these results.

3.13. Limitations reported

Limitations of studies were reported by authors primarily for issues related to internal and/or external validity (e.g., sample, attrition, measurement, intervention implementation dosage, fidelity, or design). Approximately 65% (n = 124) of studies reported some limitations regarding internal and/or external validity. In just over 6% (n = 11) of studies, authors reported some limitations of their study for diverse learners or for diverse language and/or culturally or ethnically diverse populations. However, differences were not detected in reported limitations between studies that included low-SES/poverty populations and those studies that did not.

3.14. Future recommendations reported

Recommendations for future research were provided in 76% (n = 144) of the studies reviewed. Close to 47% (n = 89) of the studies provided practice recommendations. No differences in terms of recommendations were found for studies included in the low-SES/poverty subset, compared to the non-poverty sample studies. However, differences were found in whether policy recommendations were provided between studies that included low-SES/poverty populations (67%; n = 10), compared to those that did not (33%; n = 5), $X^2(1) = 7.32$, $p < 0.01$.

4. Discussion

The purpose for this survey was to characterize the research literature examining communication and language interventions that have been implemented by non-parental caregivers in child care, early learning, and intervention programs. We expected the distribution of research studies to be far from uniform across these features, as many factors influence the design and implementation of projects, including societal and individual judgment of importance, research funders' priorities, availability of interventions with some prior evidence of effectiveness, ability to recruit both settings and families, demographic differences, and many more. Nevertheless, we felt that surveying the state of the intervention research, documenting the strengths and gaps in the literature, and examining interventions and practices delivered by caregivers in child care and early intervention was useful for the design, implementation and interpretation of future research.

4.1. "Who" and "where" of early communication and language studies

Our first research question concerned the nature of the children who have received interventions for communication or language by non-parental adults.

Approximately one-third of the studies surveyed specifically reported including some children from low-SES/poverty backgrounds in their samples, although it was often not clear how much variability was in the sample in this respect. Participants in studies are often recruited from one program or setting (e.g., a single program or classroom). Consequently, we have demonstrations of communication and language interventions being delivered to ill-defined populations under generally narrow conditions. Demonstrations taken to scale across multiple programs, early childhood service systems (i.e., EHS, HS, Parents as Teachers, Part C early intervention, and community-based child care), as well as community-health organizations, await further exploration (Greenwood et al., 2017; Hassinger-Das et al., 2017).

4.1.1. Participants and settings

Sample sizes were generally small across studies, with over one-third of the studies including 10 or fewer child participants, and

fewer than 10% reporting the inclusion of samples larger than 200. When attrition was reported, it was higher in studies in the low-SES/poverty subset than in studies of non-poverty samples. For the most part, studies included preschool-aged children between the ages of 3 and 5 years. Surprisingly few intervention studies have focused on infants despite evidence suggesting that poverty and associated risk appear to exert their influence early in a child's life, prior to age 3 (Reynolds, Rolnick, Englund, & Temple, 2010), and evidence for the importance of those earliest years for language, social and schooling outcomes (e.g., Hart & Risley, 1995, 1999; Fernald et al., 2013; Rowe et al., 2012; Romeo et al., 2018; Walker et al., 1994). Studies that did include infants were more likely to include children from low-SES/poverty backgrounds who may be most vulnerable to deficiencies in language learning. The very low number of studies including infants and younger toddlers may have been driven more by convenience or policy than by scientific design. There are fewer openings in child care programs for infants and correspondingly higher adult-infant ratio requirements as well as smaller classrooms that cost more to maintain and for which there is no publicly-funded platform (Aber, 2012; Ruzek, Burchinal, Farkas, & Duncan, 2013).

Child-directed interventions addressing communication and language are more often initiated when children are close to their third birthday and expected to be communicating beyond a prelinguistic level. Given the large variability as to the age at which children begin to use words – typically beginning at 12 and 15 months but sometimes not until 24 months – and when they are expected to be more proficient at communicating (closer to 3 years), it may be that the impetus to include younger toddlers or infants in language-focused studies is not evident until it is clear that they are not meeting developmental milestones (e.g., Warren & Walker, 2005).

4.1.2. Race and ethnicity

Reporting of race/ethnicity and home language in studies was also infrequent, with just under a quarter of the studies reporting information about the race and/or ethnicity of child participants, and just over a quarter, reporting home language status. When it was reported, race and/or ethnicity was more common in studies of low-SES samples. With the overrepresentation of minority and linguistically diverse children in low-SES/poverty households, these results, while perhaps not surprising, are an important indicator of continued economic disparities experienced by children from racial, ethnic, and linguistically diverse homes (e.g., Hammer et al., 2014; Hoff, 2013). Underreporting of demographic information of child participants decreases the potential for gathering information about how interventions may or may not be beneficial for children from diverse racial, ethnic, or linguistic populations.

4.1.3. Children with disabilities

Children with disabilities were included in over 63% of the studies reviewed. Unlike studies including children from diverse racial/ethnic, and linguistic backgrounds, studies that included children with disabilities were less likely to be part of the low-SES/poverty study subset or less often included SES information in descriptions of study samples. Children with ASD were reported to be participants in almost half of the studies reporting disability status. This may be due to the fact that children from racial/ethnic and linguistically diverse backgrounds are less likely to receive an ASD diagnosis, compared to children from majority groups (e.g., Mandell et al., 2009). Tek and Landa (2012) report for example that more subtle communication delays are likely to go undetected for minority toddlers, contributing to a delay in diagnosis and timely receipt of intervention.

4.1.4. Teacher and interventionists

Most of the studies surveyed did not specify the level of education attained by teachers or other early childhood staff who delivered interventions. Given that teacher level of education is associated with quality of teaching (e.g., Love et al., 2012; Pianta et al., 2005; Snyder et al., 2012), the omission of information concerning teacher and/or therapist education level or training level makes it more difficult to replicate intervention studies.

4.1.5. Cultural and linguistic background of educators and interventionists

Also notable was the lack of demographic information concerning the teachers, child care providers, and other interventionists. Cultural and linguistic factors may have a significant impact, either positive or negative, on the effect of an intervention. Without this information about studies, there is a major void in the information needed to interpret and replicate intervention studies. For example, in some studies in which there may be a mismatch between children's home language and the language in which the intervention was delivered child outcomes may be impacted negatively (e.g., Castro, Páez, Dickinson, & Frede, 2011; Hammer et al., 2014).

4.2. "What" and "how" of early communication and language studies

4.2.1. Adult-directed professional development

Most studies described interventions taught to adults who then delivered the intervention to children or taught others how to implement. Group training workshops were more likely to be the format for adult training used in studies included in the low-SES/poverty subset. Although there are no definitive recommendations in terms of format for adult professional development related to child language outcomes (e.g., Markussen-Brown et al., 2017), quality and intensity of interaction in classrooms and not necessarily the professional development format, appear to be most associated with positive child outcomes (e.g., Markussen-Brown et al., 2017; Snyder et al., 2012). That said, providing instruction through single workshops alone has not been associated with lasting adult or child outcomes (Sheridan, Edwards, Marvin, & Knoche, 2009; Snyder, Hemmeter, & Fox, 2015).

4.2.2. Child-focused language interventions

Most of the studies included in this survey reported delivering an intervention package (e.g., dialogic and shared storybook reading, milieu and responsive teaching) or combination of strategies or practices to children. For those that did not, investigators reported analyzing individual intervention strategies (e.g., modeling, prompting, expansion, imitation, time delay, commenting and labeling) that, in many cases, are also components of an intervention package. Our analysis revealed that studies of intervention packages, combinations, or hybrids of practices or strategies were more likely to be conducted with samples of children included in the low-SES/poverty subset of studies. This may well be a result of individual strategies being part of interventions more often delivered to children with disabilities, and ASD in particular. Modeling for example was reported to be used more frequently in studies that did not include children from low-SES/poverty backgrounds and more often reported to be used with children who have disabilities (e.g., Schreibman et al., 2015).

Close to a quarter of the interventions surveyed were described variously as milieu teaching, enhanced milieu, or prelinguistic milieu communication (e.g., Hart & Risley, 1975; Yoder & Warren, 2002; Kaiser et al., 2000). Given the array of terms used to describe milieu teaching interventions and component strategies (e.g., commenting, time delay) across language intervention packages (i.e., dialogic reading), the extent of the use of milieu teaching in

child care and intervention programs may be underrepresented in the literature (Warren & Walker, 2005). Although milieu (e.g., Harjusola-Webb & Robbins, 2012; Warren et al., 2008), and responsive teaching interventions (e.g., Tannock et al., 1992), have been reported to be effective in studies conducted in child care (e.g., Smith, Warren, Yoder, & Feurer, 2004), they have primarily been implemented with parents of children with disabilities under clinical application (Roberts & Kaiser, 2011) and are not necessarily part of the curriculum in child care or intervention programs (Schwartz, Carta, & Grant, 1996; Smith et al., 2004; Walker, Bigelow et al., 2008).

4.2.3. Intervention implementation fidelity

Only half of the studies reviewed reported the measurement of intervention fidelity using direct observation, checklists and/or rating scales. The quality of fidelity measurement was determined to be weak or inadequate in close to 20% of the studies surveyed. Constraints on the quality of child care and community-based programs serving infants and young children in terms of teacher education and teacher–child ratios, for example, have direct implications for how well interventions can be implemented and the potential for interventions to improve language outcomes (Hindman & Wasik, 2013; Justice et al., 2008; Lin & Magnuson, 2018; Vernon-Feagans et al., 2013). Poor resources, high child-to-staff ratios (Burchinal et al., 2000), limited opportunities for professional development or intervention support (Snyder et al., 2012), make it less likely that practices related to positive outcomes can be implemented with high fidelity (Dunst et al., 2013; Warren & Walker, 2005).

Increased specificity of fidelity across intervention design, training, delivery, and receipt, as recommended by Gearing et al. (2011) could provide the structure needed for the measurement of intervention fidelity and facilitate the successful replication of studies (Dunst et al., 2013). Fidelity measurement, therefore, remains an important area requiring more attention.

4.2.4. Assessment issues

Most studies reported using standardized norm-referenced measures, and this was most common in studies of low-SES/poverty samples. The overrepresentation of children from minority backgrounds in the low-SES/poverty subsample, and concerns as to the lack of representation of economically, culturally and linguistically diverse children in normative samples, calls into question the validity of these measures for diverse language learners (e.g., AERA, 2014; Bagnato, Neisworth, & Pretti-Frontczak, 2010; Hammer et al., 2014; Laing & Kamhi, 2003; Larson, 2016). Additionally, the lack of sensitivity of standardized norm-references to measure intervention change (e.g., Akers et al., 2016; Greenwood, Carta, & McConnell, 2011; Odom et al., 2005) calls into question the reliance on standardized norm-reference measures. This is particularly relevant for infants and young children from economically, culturally and linguistically diverse backgrounds, including children with disabilities.

Observational measures, including language sampling, and other measures of social communication were also more likely to be conducted in studies with non-poverty samples, whereas studies reporting measurement of receptive language were more likely to be in the low-SES/poverty subset. These patterns suggest that fewer studies with low-SES/poverty samples are providing interventions focused on expressive or social communication skills. Further, with few measures of prelinguistic and early communication sensitive to intervention efforts (e.g., Walker, Carta et al., 2008), the logistics involved in measuring communication and language outcomes for infants and young children remains a potential barrier to accurate and sensitive intervention measurement (e.g., Bagnato et al., 2010; Greenwood et al., 2011).

Missing or incomplete datasets were reported in about half of the studies reviewed and were more likely to be reported for the studies included in the low-SES/poverty subset. Using the criteria recommended by Kratochwill et al. (2013) for the 58 single-subject studies, the quality of evidence was highly variable. This information has implications for future study design and the need to replicate studies using updated methodological standards for evidence-based practice.

Effect size statistics were reported for only 32% of the studies reviewed, and most commonly reported in studies that included children from low-SES/poverty studies. Effect size metrics were more likely to be reported in studies analyzing dialogic/shared book reading and vocabulary interventions and less likely for studies analyzing verbal interaction. Effect size reporting related to research design, study sample size, and type of measure (e.g., standardized norm-reference measure, researcher-developed measure) in our sample are noteworthy. For example, it was more likely that effect sizes were reported for studies in which randomized-treatment designs were used; less likely for quasi-experimental and single-subject design studies. Overreliance on effect size metrics for language intervention studies with early childhood populations might therefore lead to conclusions skewed toward larger N studies. Using predominantly randomized treatment designs employing standardized norm-referenced measures that may not be representative of ethnic or linguistically diverse populations, aligned with intervention target behaviors, or sensitive to intervention behavior change (Bagnato et al., 2010; Cook & Odom, 2013; Hammer et al., 2014; Snyder, 2006). As noted by Cook and Odom (2013), the relationship between efficacy and implementation in determining impact is synergetic. Understanding the contributions and limitations of intervention research relative to implementation remains critical (Blase, Van Dyke, & Fixsen, 2009; Walker, 2011).

4.3. How much do we really know about this intervention research?

Perhaps the most surprising finding from this survey is the degree of missing information. Information that was frequently omitted in the studies reviewed is of great importance for interpreting research results and ultimately for practice. For instance, the degree of SES and race/ethnicity variability in study samples, the training and cultural and linguistic background of child care providers and teachers, how well groups were matched in quasi-experimental designs, the level of fidelity of intervention implementation and its relation to child outcomes, attrition, and effect sizes are important if studies are to inform practice. A valuable innovation of the field would be the adoption of a consistent framework for designing, implementing and reporting intervention studies. Guidelines established by the Consolidated Standards of Reporting Trials Consort Group (Schulz, Altman, & Moher, 2010) for randomized trials, may be a resource. The What Works Clearing House Procedures and Standards (WWC) in addition to quality indicators for conducting group and quasi-experimental studies (Gersten et al., 2005) and standards for single-subject design studies (Kratochwill et al., 2013), are resources for guiding the design of intervention studies. Gearing et al. (2011) also provide a general guide to increase fidelity procedures in community-based social and behavioral research.

4.4. Summary of strengths of the literature

Strengths emerging from this survey of communication and language intervention studies are summarized below:

- There is a substantial inventory of published intervention studies addressing early language and communication for young children with and without disabilities.
- Interventions are delivered using primarily modeling, play-based methods, adult–child interaction, discrete trial, and some technology and media.
- Dialogic/shared book reading interventions were more likely to include children from low-SES/poverty backgrounds.
- Standardized, norm-referenced, language sampling, observational and author-created measures with acceptable reliability and validity were used to document outcomes.
- Studies analyzing interventions using group comparisons were likely to specify treatment controls and to document that comparison groups were equivalent.
- When measured, intervention implementation fidelity was reported to be strong.
- Effect size was reported for over half of the randomized trial studies and were most likely to be reported for dialogic/shared book reading and vocabulary interventions.
- In most of the studies, the interventions tested were reported to have a positive impact.

4.5. Acknowledging the gaps and needs

In addition to the over-arching problem of incomplete reporting of sample characteristics and methods, several gaps, or limitations in the literature, seem especially important for future intervention research:

- Infants and toddlers – children below 3 – have been understudied, despite evidence that intervention at an early stage can have a major impact on children and families.
- Interventions addressing communication and language should be implemented in settings serving children from low-SES/poverty backgrounds.
- The interaction of disability status and low-SES/poverty needs more careful analysis.
- Future studies should include culturally/linguistically diverse infants and young children.
- Larger samples are needed to estimate effect size, and to study individual differences in response to intervention.
- Professional development, implementation, and fidelity issues have not received the attention they warrant for understanding the scale up and broader impact of intervention.
- There is a need for replication across different settings in which children receive services.
- Designs that go beyond evaluating an entire package against a control group, either by comparing related interventions or systematically comparing variations are needed.
- Overreliance on standardized norm-reference measures may not provide accurate measurement of children from diverse cultural/linguistic and SES backgrounds.
- There is a need for measures that are sensitive to intervention change and inform practice.
- Generalization of intervention effects to new environments has seldom been examined.
- Interventions should be taken to scale in child care and early intervention programs.

5. Conclusions

Findings from this systematic survey of the literature reporting the characteristics of published intervention studies conducted by non-parental caregivers in child care, early learning, and early intervention programs, highlight a number of issues relevant to identifying interventions that have potential to address the word gap. They give both grounds for the promise of intervention to address this topic, and an awareness of limitations that need to be addressed for those efforts to be successful. Perhaps the greatest need is for more transparency and consistency in research and research reporting so that individual studies can be replicated and evidence translated and integrated into practice. The results obtained so far provide convincing evidence that early language development can be facilitated under challenging conditions, and the research described in this paper suggests some specific tools for doing that even better.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ecresq.2019.02.010.

References

Aber, L. (2012). Poor and low-income families, infant/toddler development, and the prospects for change. In S. L. Odom, E. Pungello, & N. Gardner-Neblett (Eds.), *Re-visioning the beginning: Implications of developmental and health science for infants and toddler care and poverty* (pp. 3–18). NY: Guilford Press.

ACF. (2015). *U.S. Department of Health and Human Services, Administration for Children and Families*. Washington, DC: Office of Head Start Program Information Report, 2015.

Adair, J. K., Colegrove, K. S., & McManus, M. E. (2017). How the word gap argument negatively impacts young children of Latinx immigrants' conceptualizations of learning. *Harvard Educational Review*, *87*, 309–334.

AERA (American Educational Research Association), APA (American Psychological Association), & NCME (National Council on Measurement in Education). (2014). *Standards for educational and psychological testing*. Washington, DC: AERA.

Aikens, N. L., & Barbarin, O. (2008). Socioeconomic differences in reading trajectories: The contribution of family, neighborhood, and school contexts. *Journal of Educational Psychology*, *100*(2), 235–251. http://dx.doi.org/10.1037/0022-0663.100.2.235

Aikens, N., Knas, E., Malone, L., Tarullo, L., & Harding, J. F. (2017). *A spotlight on dual language learners in head start: FACES 2014, OPRE report 2017-99*. Washington, DC: Office of Planning, Research, and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Akers, L., Del Grosso, P., Snell, E. K., Atkins-Burnett, S., Wasik, B., Carta, J., et al. (2016). Tailored teaching: Emerging themes from the literature on teachers' use of ongoing child assessment to individualize instruction. *NHSA Dialog*, *18*(3), 133–150.

Alexander, D. R., & Entwisle, K. L. (1988). Achievement in the first 2 years of school: Patterns and processes. *Monographs Society of Research in Child Development*, *53*(2), 1–157.

Bagnato, S. J., Neisworth, J. T., & Pretti-Frontczak, K. (2010). *Linking authentic assessment and early childhood intervention: Best measures for best practices* (second edition). Baltimore, MD: Paul H. Brookes Publishing Co.

Bakeman, R., Adamson, L. B., Brown, J. V., & Eldridge, M. (1989). Can early interaction predict? How and how much? In M. H. Bornstein, & N. A. Krasnegor (Eds.), *Stability and continuity in mental development: Behavioral and biological perspectives* (pp. 235–248). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

Baugh, J. (2017). Meaning-less differences: Exposing fallacies and flaws in the word gap: Hypothesis that conceal a dangerous "language trap" for low-income American families and their children. *International Multilingual Research Journal*, *11*, 39–51.

Beeghly, M. (2006). Translational research on early language development: Current challenges and future directions. *Development and Psychopathology*, *18*(3), 737–757. http://dx.doi.org/10.1017/S0954579406060366

Blase, K. A., Van Dyke, M., & Fixsen, D. (2009). . *Evidence-based programming in the context of practice and policy. Social policy report* (Vol. XXIII, #3) Society for Research in Child Development.

Bronfenbrenner, U. (1994). *Ecological models of human development*. pp. 1643–1647. *Effects on child and adolescent development* (Vol. 2) NY: Elsevier Science.

Burchinal, M., Howes, C., Pianta, R., Bryant, D., Early, D., Clifford, R., et al. (2008). Predicting child outcomes at the end of kindergarten from the quality of pre-kindergarten teacher–child interactions and instruction. *Applied Developmental Science*, *12*(3), 140–153.

Burchinal, M., McCartney, K., Steinberg, L., Crosnoe, R., Friedman, S. L., McLoyd, V., et al. (2011). Examining the Black–White achievement gap among low-income children using the NICHD study of early child care and youth development. *Child Development*, *82*(5), 1404–1420.

Burchinal, M., Roberts, J. E., Zeisel, S. A., Hennon, E. A., & Hooper, S. (2006). Social risk and protective child, parenting, and child care factors in early elementary school years. *Parenting: Science and Practice*, *6*(1), 79–113.

Burchinal, M. R., Roberts, J. E., Riggins, R., Jr., Zeisel, S. A., Neebe, E., & Bryant, D. (2000). Relating quality of center-based child care to early cognitive and language development longitudinally. *Child Development*, *71*, 339–357.
Buysse, V. (2011). Access, participation, and supports: The defining features of high-quality inclusion. *Zero to Three*, *31*(4), 24–29.
Buysse, V., Peisner-Feinberg, E., Páez, M., Hammer, C. S., & Knowles, M. (2014). Effects of early education programs and practices on the development and learning of dual language learners: A review of the literature. *Early Childhood Research Quarterly*, *29*(4), 765–785.
Campbell, F. A., & Ramey, C. T. (1994). Effect of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development*, *65*, 684–698.
Campbell, F. A., Pungello, E. P., Burchinal, M., Kainz, K., Pan, Y., Wasik, B. H., et al. (2012). Adult outcomes as a function of an early childhood educational program: An Abecedarian project follow-up. *Developmental Psychology*, *48*, 1033–1043.
Carta, J., Greenwood, C., Baggett, K., Buzhardt, J., & Walker, D. (2012). Research-based approaches for individual caregiving and educational interventions for infants and toddlers in poverty. In S. L. Odom, E. Pungello, & N. Gardner-Neblett (Eds.), *Re-visioning the beginning: The implications of developmental and health science for infants and toddler care and poverty* (pp. 333–349). New York: Guilford Press.
Carta, J. C., Greenwood, C. R., & Walker, D. (2014). *Bridging the word gap national research network*. Washington, DC: Child and Maternal Health; Human Resources Services Administration (HRSA) (HRSA: UA6MC27762).
Castro, D. C., Páez, M. M., Dickinson, D. K., & Frede, E. (2011). Promoting language and literacy in young dual language learners: Research, practice, and policy. *Child Development Perspectives*, *5*(1), 15–21.
Catts, H., Bridges, M., Little, T., & Tomblin, J. B. (2008). Reading achievement growth in children with language impairments. *Journal of Speech, Language, and Hearing Research*, *51*, 722–738.
Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools*, *32*(1), 38–50.
Centers for Disease Control and Prevention—CDC. (2013). *Learn the signs. Act early* Program (www.cdc.gov/ActEarly).
Center for History and New Media. (2006). *Zotero* Retrieved from. https://www.zotero.org/
Centers for Disease Control and Prevention. (2018). *Ending poverty now* Report available at:. http://www.childrensdefense.org/library/PovertyReport/EndingChildPovertyNow.html
Child Trends Databank. (2016). *Children in poverty*. www.childtrends.org-poverty
Clarke-Stewart, K. A., Gruber, C. P., & Fitzgerald, L. M. (1994). *Children at home and in day care*. Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.
Cook, B. G., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children*, *79*(2), 135–144.
Cook, B. G., Tankersley, M., & Landrum, T. J. (2009). Determining evidence-based practices in special education. *Exceptional Children*, *75*(3), 365–383.
Cooper, H., Hedges, L. V., & Valentine, J. C. (2009). *The handbook of research synthesis and meta-analysis* (second edition). NY: Russell Sage.
Dale, P. S., Crain-Thoreson, C., Notari-Syverson, A., & Cole, K. (1996). Parent–child book reading as an intervention technique for young children with language delays. *Topics in Early Childhood Special Education*, *16*(2), 213–235.
Dale, P. S., Price, T. S., Bishop, D. V. M., & Plomin, R. (2003). Outcomes of early language delay: I. Predicting persistent and transient language difficulties at 3 and 4 years. *Journal of Speech Lang Hearing Research*, *46*(3), 544–560.
Dickinson, D. K., & Porche, M. V. (2011). Relation between language experiences in preschool classrooms and children's kindergarten and fourth-grade language and reading abilities. *Child Development*, *82*(3), 870–886.
Dickinson, D., Golinkoff, R. M., & Hirsh-Pasek, K. (2010). Speaking out for language: Why language is central to reading development. *Educational Researcher*, *4*, 305–310.
Division for Early Childhood. (2014). *DEC recommended practices in early intervention/early childhood special education* Retrieved:. http://www.decsped.org/recommendedpractices
Dowsett, C. J., Huston, A. C., Imes, A. E., & Gennetian, L. A. (2008). Structural and process features in three types of child care for children from high and low income families. *Early Childhood Research Quarterly*, *23*(1), 69–93.
Dunst, C. J., Raab, M., & Trivette, C. M. (2012). Characteristics of naturalistic language intervention strategies. *Journal of Speech-Language Pathology and Applied Behavior Analysis*, *5*(3–4), 8–16.
Dunst, C. J., Trivette, C. M., & Raab, M. (2013). An implementation science framework for conceptualizing and operationalizing fidelity in early childhood intervention studies. *Journal of Early Intervention*, *35*, 85–101.
Durkin, M. S., Maenner, M. J., Meaney, F. J., Levy, S. E., DiGuiseppi, C., Nicholas, J. S., et al. (2010). Socioeconomic inequality in the prevalence of autism spectrum disorder: Evidence from a U.S. cross-sectional study. *PLoS One*, *5*(7), e11551 http://dx.doi.org/10.1371/journal.pone.0011551
Espinosa, L. M., LaForett, D. R., Burchinal, M., Winsler, A., Tien, H. C., Peisner-Feinberg, E. S., et al. (2017). *Child care experiences among dual language learners in the United States: Analyses of the early childhood longitudinal study–birth cohort* AERA Open. http://dx.doi.org/10.1177/2332858417699380
Family Life Project Key Investigators. (2013). Discussion and implications for children living in rural poverty. In L. Vernon-Feagans, M. Cox, & the FLP Key Investigators (Eds.), *The Family Life Project: An epidemiological and developmental study of young children living in poor rural communities* (78) (pp. 92–108). Monographs of the Society for Research in Child Development.
Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science*, *16*(2), 234–248.
Fleury, V. P., & Schwartz, I. S. (2017). A modified dialogic reading intervention for preschool children with autism spectrum disorder. *Topics in Early Childhood Special Education*, *37*(1), 16–28.
Fontaine, N. S., Torre, L. D., Grafwallner, R., & Underhill, B. (2006). Increasing quality in early care and learning environments. *Early Child Development and Care*, *17*(6:2), 157–169. http://dx.doi.org/10.1080/0300443042000302690
Gearing, R. E., El-Bassel, N., Ghesquiere, A., Baldwin, S., Gillies, J., & Ngeow, E. (2011). Major ingredients of fidelity: A review and scientific guid to improving quality of intervention research implementation. *Clinical Psychology Review*, *31*, 79–88.
Gersten, R., Fuchs, L. S., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M. S. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children*, *71*(2), 149–164. http://dx.doi.org/10.1177/001440290507100202
Gilkerson, J., Richards, J. A., Warren, S. F., Oller, K., Russo, R., & Vohr, B. (2018). Language experience in the second year of life and language outcomes in late childhood. *Pediatrics*, *142*(4), e20174276.
Goldstein, H., Kaczmarek, L., Pennington, R., & Shafer, K. (1992). Peer-mediated intervention: Attending to, commenting on, and acknowledging the behavior of preschoolers with autism. *Journal of Applied Behavior Analysis*, *25*, 289–305.
Golinkoff, R. M., Hoff, E., Rowe, M. L., Tamis-LeMonda, C. S., & Hirsh-Pasek, K. (2018). Language matters: Denying the existence of the 30-million-word gap has serious consequences. *Child Development*, http://dx.doi.org/10.1111/cdev.13128
Greenwood, C. R., Carta, J. J., & McConnell, S. (2011). Advances in measurement for universal screening and individual progress monitoring of young children. *Journal of Early Intervention*, *33*(4), 254–267. http://dx.doi.org/10.1177/1053815111428467
Greenwood, C. R., Carta, J. J., Walker, D., Watson-Thompson, J., Gilkerson, J., Larson, A. L., et al. (2017). Conceptualizing a public health prevention intervention for bridging the 30 million word gap. *Clinical Child and Family Psychology Review*, *20*, 3–24.
Greenwood, C. R., Walker, D., & Utley, C. A. (2002). Relationships between social-communicative skills and life achievements. *Promoting social communication: Children with developmental disabilities from birth to adolescence*, 345–370.
Halle, T., Forry, N., Hair, E., Perper, K., Wandner, L., Wessel, J., et al. (2009). *Disparities in early learning and development: Lessons from the Early Cildhood Longitudinal Study-Birth Cohort (ECLS-B)*. Washington, DC: Child Trends.
Hammer, C. S., Hoff, E., Uchikoshi, Y., Gillanders, C., Castro, D. C., & Sandilos, L. E. (2014). The language and literacy development of young dual language learners: A critical review. *Early Childhood Research Quarterly*, *29*, 715–733.
Harjusola-Webb, S. M., & Robbins, S. H. (2012). The effects of teacher-implemented naturalistic intervention on the communication of preschoolers with autism. *Topics in Early Childhood Special Education*, *32*(2), 99–110.
Hart, B., & Risely, T. R. (1992). American parenting in language-learning children: Persisting differences in family–child interactions observed in natural home environments. *Developmental Psychology*, *28*(6), 1096–1105.
Hart, B., & Risley, T. R. (1975). Incidental teaching of language in the preschool. *Journal of Applied Behavior Analysis*, *8*(4), 411–420.
Hart, B., & Risley, T. R. (1978). Promoting productive language through incidental teaching. *Education and Urban Society*, *10*, 407–429.
Hart, R., & Risley, T. R. (1995). *Meaningful differences in the everyday experiences of young American children*. Baltimore: Brookes.
Hart, B., & Risley, T. R. (1999). *The social world of children learning to talk*. Baltimore: Brookes.
Hart, B., & Risley, T. R. (2003). The early catastrophe: The 30 million word gap by age 3. *American Educator*, *27*(1), 4–9.
Hassinger-Das, B., Hirsh-Pasek, K., & Golinkoff, R. M. (2017). The case of brain science and guided play: A developing story. *Young Children*, *72*(2), 45.
Healthy Hunger-Free Kids Act. (2010). *Public law 111–296*. 111th US Congress. Published December 13, 2010. 124 STAT. 3183. www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/PLAW-111publ296.pdf
Hebbeler, K., & Gerlach-Downie, S. (2002). Inside the black box of home visiting: A qualitative analysis of why intended outcomes were not achieved. *Early Childhood Research Quarterly*, *17*(1), 28–51. http://dx.doi.org/10.1016/S0885-2006(02)00128-x
Heckman, J. J. (2006). Skill Formation and the economics of investing in disadvantaged children. *Science*, *312*(5782), 1900–1902.
Heckman, J. J. (2008). Schools, skills and synapses. *Economic Inquiry*, *46*, 289–324. http://dx.doi.org/10.1111/j.1465-7295.2008.00163.x
Hepting, N. H., & Goldstein, H. (1996). What's natural about naturalistic language intervention? *Journal of Early Intervention*, *20*(3), 249–264.
Hindman, A. H., & Wasik, B. A. (2013). Vocabulary learning in head start: Nature and extent of classroom instruction and its contributions to children's learning. *Journal of School Psychology*, *51*, 387–405.
Hirsh-Pasek, K., Adamson, L., Bakeman, R., Owen, M. T., Golinkoff, R. M., Pace, A., et al. (2015). The contribution of early communication quality to low-income children's language success. *Psychological Science*, *26*(7), 1071–1083.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development*, *74*, 1368–1378.
Hoff, E. (2013). Interpreting the early language trajectories of children from low-SES and language minority homes: Implications for closing the achievement gaps. *Developmental Psychology*, *49*, 4–14.
Hoff-Ginsberg, E. (1985). Some contributions of mothers' speech to their children's syntactic growth. *Journal of Child Language*, *12*(2), 367–385. http://dx.doi.org/10.1017/S0305000900006486
Howes, C. (1997). Children's experiences in center-based child care as a function of teacher background and adult:child ratio. *Merrill-Palmer Quarterly*, *43*(3), 404–425.
Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, *27*(2), 236–248.
Huttenlocher, J., Waterfall, H., Vasilyeva, M., Vevea, J., & Hedges, L. V. (2010). Sources of variability in children's language growth. *Cognitive Psychology*, *61*(4), 343–365.
Justice, L. M., Mashburn, A. J., Hamre, B. K., & Pianta, R. C. (2008). Quality of language and literacy instruction in preschool classrooms serving at-risk pupils. *Early Childhood Research Quarterly*, *23*, 51–68.
Justice, L. M., McGinty, A. S., Zucker, T., Cabell, S. Q., & Piasta, S. B. (2013). Bi-directional dynamics underlie the complexity of talk in teacher–child play-based conversations in classrooms serving at-risk pupils. *Early Childhood Research Quarterly*, *28*(3), 496–508.
Kaiser, A. P., & Roberts, M. Y. (2011). Advances in early communication and language intervention. *Journal of Early Intervention*, *33*(4), 298–309.
Kaiser, A. P., Hancock, T. B., & Nietfeld, J. P. (2000). The effects of parent-implemented enhanced milieu teaching on the social communication of children who have autism. *Journal of Early Education and Development*, *4*, 423–446.
Klass, P., Dreyer, B. P., & Mendelsohn, A. L. (2009). Reach out and read: Literacy promotion in pediatric primary care. *Advances in Pediatrics*, *56*, 11–27.
Knoche, L. L., Sheridan, S. M., Edwards, C. P., & Osborn, A. Q. (2010). Implementation of a relationship-based school readiness intervention: A multidimensional approach to fidelity measurement for early childhood. *Early Childhood Research Quarterly*, *25*, 299–313.
Kong, N., & Carta, J. J. (2013). Research synthesis of studies on responsive interaction intervention for children with or at risk for developmental delays. *Topics in Early Childhood Special Education*, *33*, 4–17.
Kratochwill, T. R., Hitchcock, J. H., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., et al. (2013). Single-case intervention research design standards. *Remedial and Special Education*, *34*, 26–38. http://dx.doi.org/10.1177/0741932512452794
Kuhl, P. K. (2010). Brain mechanisms in early language acquisition. *Neuron*, *67*(5), 713–727.
Laing, S. P., & Kamhi, A. (2003). Alternative assessment of language and literacy in culturally and linguistically diverse populations. *Language, Speech, and Hearing Services in Schools*, *34*, 44–55.
Landry, S. H., Smith, K. E., Miller-Loncar, C. L., & Swank, P. R. (1997). Predicting cognitive-language and social growth curves from early maternal behaviors in children at varying degrees of biological risk. *Developmental Psychology*, *33*(6), 1040–1053.
Larson, A. L. (2016). Language screening for infants and toddlers: A literature review of four commercially available tools. *Communication Disorders Quarterly*, *38*(1), 3–12.
Laughlin, L. (2013). *Who's minding the kids? Child care arrangements. Current population reports, P70-135*. Washington, DC: U.S. Census Bureau.
Lin, Y. C., & Magnuson, K. A. (2018). Classroom quality and children's academic skills in child care centers: Understanding the role of teacher qualifications. *Early Childhood Research Quarterly*, *42*, 215–227.
Lonigan, C. J., & Whitehurst, G. J. (1998). Relative efficacy of parent and teacher involvementa shared-reading intervention for preschool children from low-income backgrounds. *Early Childhood Research Quarterly*, *13*, 263–290.
Love, J. M., Chazan-Cohen, R., Brooks-Gunn, J., Raikes, H., Vogel, C. A., & Kisker, E. E. (2012). Beginnings of school readiness in infatn/toddler development. In S. L. Odom, E. Pungello, & N. Gardner-Neblett (Eds.), *Re-visioning the beginning: Implications of developmental and health science for infants and toddler care and poverty* (pp. 309–332). NY: Guilford Press.
Mandell, D. S., Listerud, J., Levy, S. E., & Pinto-Martin, J. A. (2002). Race differences in the age at diagnosis among medicaid-eligible children with autism. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*(12), 1447–1453.
Mandell, D. S., Wiggins, L. D., Carpenter, L. A., Daniels, J., DiGuiseppi, C., Durkin, M. S., et al. (2009). Racial/ethnic disparities in the identification of children with autism spectrum disorders. *American Journal of Public Health*, (99), 493–498.
Markussen-Brown, J., Juhl, C. B., Piasta, S., Bleses, D., Højen, A., & Justice, L. (2017). The effects of language- and literacy-focused professional development on early educators and children: A best-evidence meta-analysis. *Early Childhood Research Quarterly*, *38*, 97–115.
Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. *Review of Educational Research*, *80*(3), 300–335. http://dx.doi.org/10.3102/0034654310377087
Mendelsohn, A. L., Huberman, H. S., Berkule, S. B., Brockmeyer, C. A., Morrow, L. M., & Dreyer, B. P. (2011). Primary care strategies for promoting parent–child interactions and school readiness in at-risk families: The Bellevue project for early language, literacy, and education success. *Archives of Pediatrics & Adolescent Medicine*, *165*(1), 33–41.
Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & the PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine*, *151*, 264–269. http://dx.doi.org/10.7326/0003-4819-151-4-200908180-00135
Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. (2008). Added value of dialogic parent–child book readings: A meta-analysis. *Early Education and Development*, *19*, 7–26.
NICHD Early Child Care Research Network. (2000). Characteristics and quality of child care for toddlers and preschoolers. *Applied Developmental Science*, *4*, 116–135.
NICHD Early Child Care Research Network. (2004). Type of child care and children's development at 54 months. *Early Childhood Research Quarterly*, *19*(2), 203–230.
NICHD Early Child Care Research Network. (2005). Duration and developmental timing of poverty and children's cognitive and social development from birth through third grade. *Child Development*, *76*(4), 795–810.
Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. R. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children*, *71*(2), 137–149.
Odom, S. L., Buysse, V., & Soukakou, E. (2011). Inclusion for young children with disabilities: A quarter century of research perspectives. *Journal of Early Intervention*, *33*, 344–356.
Pace, A., Luo, R., Hirsh-Pasek, K., & Golinkoff, R. M. (2017). Identifying pathways between socioeconomic status and language development. *Annual Review of Linguistics*, *3*, 285–308.
Pan, B., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child Development*, *76*(4), 763–782.
Peisner-Feinberg, E. S., & Burchinal, M. R. (1997). Relations between preschool children's child-care experiences and concurrent development: The cost, quality, and outcomes study. *Merrill-Palmer Quarterly*, *43*(3), 451–477.
Pelatti, C. Y., Piasta, S. B., Justice, L. M., & O'Connell, A. (2014). Language- and literacy-learning opportunities in early childhood classrooms: Children's typical experiences and within-classroom variability. *Early Childhood Research Quarterly*, *29*(4), 445–456.
Peterson, P., Carta, J. J., & Greenwood, C. R. (2005). The effects of teaching enhanced milieu language teaching skills to parents in multiple risk families. *Journal of Early Intervention*, *27*, 94–109.
Phillips, D., & Adams, G. (2001). Child care and our youngest children. *The Future of Children*, *11*(1), 35–51.
Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Early, D., et al. (2005). Features of pre-kindergarten programs, classrooms, and teachers: Do they predict observed classroom quality and child–teacher interactions? *Applied Developmental Science*, *9*(3), 144–159. http://dx.doi.org/10.1207/s1532480xads0903_2
Qi, C., & Kaiser, A. (2003). Behavior problems of preschool children from low-income families: A review of the literature. *Topics in Early Childhood Special Education*, *23*, 188–216.
Reynolds, A. J., Rolnick, A. J., Englund, M. M., & Temple, J. A. (2010). Early childhood development and human capital. In *Childhood programs and practices in the first decade of life: A human capital integration*. pp. 1–26. New York, NY: Cambridge Univ. Press.
Roberts, M. Y., & Kaiser, A. P. (2011). The effectiveness of parent-implemented language interventions: A meta-analysis. *American Journal of Speech Language Pathology*, *20*, 180–199.
Rodriguez, E. T., & Tamis-LeMonda, C. S. (2011). Trajectories of the home learning environment across the first 5 years: Associations with children's vocabulary and literacy skills at prekindergarten. *Child Development*, *82*(4), 1058–1075.
Romeo, R. R., Leonard, J. A., Robinson, S. T., West, M. R., Mackey, A. P., Rowe, M. L., et al. (2018). Beyond the 30-million-word-gap: Children's conversational exposure is associated with language-related brain function. *Psychological Science*, *29*(5), 700–710.
Rowe, M. L. (2008). Child-directed speech: Relation to socioeconomic status, knowledge of child development and child vocabulary skill. *Journal of Chld Language*, *35*(1), 185–205.
Rowe, M. L. (2017). Understanding socioeconomic differences in parents' speech to children. *Child Development Perspectives*, *12*, 122–127.
Rowe, M. L., & Goldin-Meadow, S. (2009). Differences in early gesture explain SES disparities in child vocabulary size at school entry. *Science (New York, N.Y.)*, *323*(5916), 951–953.
Rowe, M. L., Levine, S. C., Fisher, J., & Goldin-Meadow, S. (2009). The joint effects of biology and input on the language development of brain-injured children. *Developmental Psychology*, *45*, 90–102. http://dx.doi.org/10.1037/a0012848
Rowe, M. L., Raudenbush, S., & Goldin-Meadow, S. (2012). The pace of early vocabulary growth helps predict later vocabulary skill. *Child Development*, *83*(2), 508–525.
Ruzek, E., Burchinal, M., Farkas, G., & Duncan, G. J. (2013). The quality of toddler child care and cognitive skills at 24 months: Propensity score analysis results from the ECLS-B. *Early Childhood Research Quarterly*, *29*, 12–21.
Samaroff, A. (2000). Ecological perspectives on developmental risk. In J. Osofsky, & H. Fitzgerald (Eds.), *WAIMH Handbook of infant mental health* (Vol. 4) (pp. 4–33). NY: Wiley.
Sandall, S. R., & Schwartz, I. S. (2013). Building blocks: A tiered model to address the needs of children with disabilities and promote high quality inclusion. In V.

Buysse, & E. Peisner-Feinberg (Eds.), *Handbook of response to intervention (RTI) in early childhood*. Baltimore: Paul H. Brookes.
Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., McGee, G. G., et al. (2015). Naturalistic developmental behavioral interventions: Empirically validated treatments for autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *45*(8), 2411–2428.
Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT, statement: Guidelines for reporting parallel group randomised trials. *BMJ*, *340*, 698–702. http://www.consort-statement.org
Schwartz, I., Carta, J. J., & Grant, S. (1996). Examining the use of recommended language-intervention practices in early childhood special education classrooms. *Topics Early Childhood Special Education*, *16*(2), 251–272.
Schwartz, I. S., Thomas, C. J., McBride, B., & Sandall, S. R. (2013). A school-based preschool program for children with ASD: A quasi-experimental assessment of child change in project DATA. *School Mental Health*, *5*(4) http://dx.doi.org/10.1007/s12310-013-9103-7
Schweinhart, L. J., Barnes, H. V., & Weikart, D. P. (1993). *Significant benefits: The high/scope perry preschool study through age 27. Monographs of the high/scope educational research foundation* (Vol. 10) Ypsilanti, MI: High/Scope Press.
Sheridan, S. M., Edwards, C. P., Marvin, C. A., & Knoche, L. L. (2009). Professional development in early childhood programs: Process issues and research needs. *Early Education and Development*, *20*(3), 377–401.
Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighborhoods: The science of early childhood development*. Washington, D.C: National Academies Press.
Smith, J. D., Warren, S. F., Yoder, P. J., & Feurer, I. (2004). Teachers' use of naturalistic communication intervention practices. *Journal of Early Intervention*, *27*, 1–14.
Snow, C. E., Tabors, P. O., & Dickinson, D. K. (2001). Language development the preschool years. In D. K. Dickinson, & P. O. Tabors (Eds.), *Beginning literacy with language* (pp. 1–23). Baltimore, MD: Brookes.
Snyder, P. (2006). Best available research evidence: Impact on research in early childhood. In V. Buysse, & P. Wesley (Eds.), *Evidence-based practice in the early childhood field* (pp. 35–70). Washington, DC: Zero to Three Press.
Snyder, P., Hemmeter, M. L., Artman Meeker, K., Kinder, K., Pasia, C., & McLaughlin, T. (2012). Characterizing key features of the early childhood professional development literature. *Infants & Young Children*, *25*, 188–212.
Snyder, P. A., Hemmeter, M. L., & Fox, L. (2015). Supporting implementation of evidence-based practices through practice-based coaching. *Topics in Early Childhood Special Education*, *35*(3), 133–143.
Sperry, D. E., Sperry, L. L., & Miller, P. J. (2019). Reexamining the verbal environments of children from different socioeconomic backgrounds. *Child Development*, http://dx.doi.org/10.1111/cdev.13072
Storch, S. A., & Whitehurst, G. J. (2002). Oral language and code-related precursors to reading: Evidence from a longitudinal structural model. *Developmental Psychology*, *38*, 934–947.
Tannock, R., Girolametto, L., & Siegel, L. S. (1992). Language intervention with children who have developmental delays: Effects of an interactive approach. *American Journal of Mental Retardation: AJMR*, *97*(2), 145–160.
Tek, S., & Landa, R. J. (2012). Differences in autism symptoms between minority and non-minority toddlers. *Journal of Autism and Developmental Disorders*, *42*(9), 1967–1973.
Towson, J. A., Fettig, A., Fleury, V. P., & Abarca, D. L. (2017). Dialogic reading in early childhood settings: A summary of the evidence base. *Topics in Early Childhood Special Education*, *37*(3), 132–146.
Trent-Stainbrook, A., Kaiser, A., & Frey, J. (2007). Older siblings' use of responsive interaction strategies and effects on their younger siblings with down syndrome. *Journal of Early Intervention*, *29*(4), 273–286.
Vallotton, C. D., Harewood, T., Ayoub, C. A., Pan, B., Mastergeorge, A. M., & Brophy-Herb, H. (2012). Buffering boys and boosting girls: The protective and promotive effects of early head start for children's expressive language in the context of parenting stress. *Early Childhood Research Quarterly*, *27*(4), 695–707. http://dx.doi.org/10.1016/j.ecresq.2011.03.001
Vernon-Feagans, L., Bratsch-Hines, M. E., & the Family Life Project Key Investigators. (2013). Caregiver–child verbal interactions in child care: A buffer against poor language outcomes when maternal language input is less. *Early Childhood Research Quarterly*, *28*(4), 858–873.
Walker, D. (2011). Evidence-based practice in early childhood intervention. In C. J. Groark, & L. Kaczmarek (Eds.), *Early childhood intervention: Shaping the future for children with special needs and their families, three volumes* (Vol. 2) (pp. 147–167). Santa Barbara, CA: ABC-CLIO, Praeger.
Walker, D., & Carta, J. J. (2020). Intervention research to improve language-learning opportunities and address the inequities of the word gap. *Early Childhood Research Quarterly*, *50*(P1), 1–5.
Walker, D., Greenwood, C., Hart, B., & Carta, J. (1994). Prediction of school outcomes based on early language production and socioeconomic factors. *Child Development*, *65*, 606–621.
Walker, D., Bigelow, K. M., & Harjusola-Webb, S. (2008). Increasing communication and language-learning opportunities for infants and toddlers. *Young Exceptional Children Monograph, Series*, *10*.
Walker, D., Carta, J. J., Greenwood, C., & Buzhardt, J. (2008). Individual growth and development indicators: Their use in progress monitoring and intervention decision making in early education. *Exceptionality*, *16*, 33–47.
Warren, S. F., & Walker, D. (2005). Fostering early communication and language development. In D. M. Teti (Ed.), *Handbook of research methods in developmental science* (pp. 249–270). Malden, MA: Blackwell Publishers.
Warren, S. F., Fey, M. E., Finestack, L., Brady, N. C., Bredin-Oja, S. L., & Fleming, K. K. (2008). A randomized trial of longitudinal effects of low-intensity responsivity education/prelinguistic milieu teaching. *Journal of Speech, Language, and Hearing Research*, *51*(2), 451–470.
Wasik, B. A., Hindman, H., & Snell, E. K. (2016). Book reading and vocabulary development: A systematic review. *Early Childhood Research Quarterly*, *37*, 39–57.
Wasik, B. H., Ramey, C. T., Bryant, D. M., & Sparling, J. J. (1990). A longitudinal study of two early intervention strategies: Project CARE. *Child Development*, *61*, 1682–1696.
Wetherby, A. M., & Prizant, B. M. (1993). Profiling communication and symbolic abilities in young children. *Communication Disorders Quarterly*, *15*(1), 23–32.
What Works Clearinghouse. (2014). *Procedures and standards handbook (3.0.)* Retrieved from. https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc_procedures_v3_0_standards_handbook.pdf
Whitehurst, G. J., & Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development*, (69), 848–872.
Wolery, M. (2011). Intervention research: The importance of fidelity measurement. *Topics in Early Childhood Special Education*, *31*, 155–157.
Yazejian, N., Bryant, D., Freel, K., Burchinal, M., & the Educare Learning Network (ELN) Investigative Team. (2015). High-quality early education: Age of entry and time in care differences in student outcomes for English-only and dual language learners. *Early Childhood Research Quarterly*, *32*, 23–39.
Yoder, P., & Stone, W. (2006). Randomized comparison of two communication interventions for preschoolers with autism spectrum disorders. *Journal of Consultation Clinical Psychology*, *74*(3), 426–435. http://dx.doi.org/10.1037/0022-006X.74.3.42
Yoder, P. J., & Warren, S. F. (2002). Effects of prelinguistic milieu teaching and parent responsivity education on dyads involving children with intellectual disabilities. *Journal of Speech, Language, and Hearing Research*, *45*, 1297–1310.
Yoshikawa, H., Aber, J. L., & Beardslee, W. R. (2012). The effects of poverty on the mental, emotional, and behavioral health of children and youth: Implications for prevention. *American Psychologist*, *67*(4), 272.
Zaslow, M., Anderson, R., Redd, Z., Wessel, J., Tarullo, L., & Burchinal, M. (2010). *Quality dosage, thresholds, and features in early childhood settings: A review of the literature, OPRE 2011-5*. Washington, DC: Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Dept. of Health and Human Services.
Zauche, L. H., Thul, T. A., Darcy Mahoney, A. E., & Stapel-Wax, J. L. (2016). Influence of language nutrition on children's language and cognitive development: An integrated review. *Early Childhood Research Quarterly*, *36*, 318–333.