Naturalistic Instructional Approaches in Early Learning: A Systematic Review

Patricia A. Snyder[1], Salih Rakap[1], Mary Louise Hemmeter[2], Tara W. McLaughlin[1], Susan Sandall[3], and Mary E. McLean[4]

Abstract

Naturalistic instructional approaches are used to provide intentional and systematic instruction to young children with disabilities during typically occurring activities. Several naturalistic instructional approaches have been described in the extant literature, although different terms have been used to refer to these approaches (e.g., activity-based intervention, embedded instruction). The purpose of this systematic review was to identify, examine, and summarize the empirical literature focused on naturalistic instructional approaches for preschool children with disabilities when instruction was delivered in classroom settings. Forty-three studies that met established inclusion criteria were reviewed and coded using systematic procedures. Studies were coded to permit within- and across-approach comparisons as well as with respect to quality indicators for study design features and relationships to reported outcomes. Findings suggest a need to specify clearly the contextual and procedural components of naturalistic instructional approaches to advance understanding about this evidence-based practice and the functional relationships between implementation of the approaches and child learning outcomes.

Introduction

Naturalistic instructional (NI) approaches have been developed to support children's participation and learning in inclusive settings (Hemmeter, 2000; Odom, 2000; Pretti-Frontczak & Bricker, 2004; VanDerHeyden, Snyder, Smith, Sevin, & Longwell, 2005; Wolery & Hemmeter, 2011). These approaches have helped early childhood educators support children's access to and participation in the general preschool curriculum, while giving individualized support and instruction in the context of typically occurring classroom activities. They typically involve *embedding* (providing learning trials during naturally occurring or motivating activities) and

[1]University of Florida, Gainesville, USA
[2]Vanderbilt University, Nashville, TN, USA
[3]University of Washington, Seattle, USA
[4]University of Wisconsin–Milwaukee, USA

Corresponding Author:
Patricia A. Snyder, Anita Zucker Center for Excellence in Early Childhood Studies, School of Special Education, School Psychology, and Early Childhood Studies, University of Florida, G315 Norman Hall, P.O. Box 117050, Gainesville, FL 32611, USA.
Email: patriciasnyder@coe.ufl.edu

embedded learning opportunities (providing intentional and systematic instructional episodes within and across activities based on children's individualized learning needs and outcomes).

Providing embedded learning opportunities for children within and across activities and environments is a recommended practice in early intervention/early childhood special education. Practitioners embed instruction within and across activities and environments to provide learning opportunities relevant for the context (Division for Early Childhood, 2014; Wolery, 2005). Embedded learning opportunities promote child engagement and learning during typically occurring classroom activities (Snyder, Hemmeter, McLean, Sandall, & McLaughlin, 2013). Using NI approaches to embed learning opportunities in typically occurring activities has been associated with increases in child engagement (e.g., Malmskog & McDonnell, 1999) and skill acquisition (e.g., Fox & Hanline, 1993; Grisham-Brown, Schuster, Hemmeter, & Collins, 2000). In addition, use of these approaches has been shown to support generalization and maintenance of learned skills (e.g., Kaczmarek, Hepting, & Dzubak, 1996; McDonnell, 1996).

Hart and Risley's (1975) work on incidental teaching had a primary influence on the development of NI approaches (Horn & Banerjee, 2009). The passage of PL 99-457, which required services for young children with disabilities to be delivered in least restrictive or natural environments, further supported the development of NI approaches (Kaiser & Trent, 2009). Over time, several different terms have been used to describe these approaches in the extant literature, including activity-based intervention, individualized curriculum sequencing model, milieu teaching, enhanced milieu teaching, naturalistic teaching, transition-based teaching, and embedded instruction. Each of these naturalistic approaches involves the use of instructional procedures that set the occasion for embedded learning opportunities.

Despite being referred to by different terms, NI approaches could be considered a "practice" as defined by the What Works Clearinghouse (2010, p. 4) because they reflect "a named approach to promoting children's development that staff implements in interacting with children and materials in their classroom" and they share several common features (Horn & Banerjee, 2009; Rule, Losardo, Dinnebeil, Kaiser, & Rowland, 1998). First, the contexts in which instruction occurs are the typically occurring activities, routines, and experiences of a child. Second, the content of instruction focuses on learning targets or skills needed by the child to meet activity demands or characteristics and to participate more fully in typically occurring activities. Third, each intentional and systematic teaching episode is typically child-initiated or initiated by an adult based on the child's focus of attention or interest (i.e., following the child's lead), and a natural or logically planned consequence follows the child's response. Fourth, the adults who implement the instruction are those who interact regularly with the child. These four features are typically what distinguish the NI approaches described above from other instructional approaches described in the literature.

Although NI approaches share common features, differences in terminology and variations in procedural components emphasized in research and practice have made it challenging to identify, analyze, and summarize the empirical literature. Given the emphases on identifying and implementing recommended and evidenced-based practices in early childhood (Cook & Odom, 2013; Division for Early Childhood, 2014; Snyder, 2006; What Works Clearinghouse, 2010), a need exists to conduct a descriptive systematic review of the literature on NI approaches.

The purpose of our systematic review was to examine the empirical literature that met study inclusion criteria and focused on NI approaches designed to support embedded learning opportunities for young children with disabilities in typically occurring activities in classroom settings. Six research questions guided the review:

> **Research Question 1:** Across the identified studies, what term was used to characterize the NI approach implemented and how frequently was each approach used?
> **Research Question 2:** What were the conditions under which the NI approach was implemented?

Research Question 3: What were the attributes of the children and providers involved in the studies?
Research Question 4: Which of the four features of NI were reported and what were the key procedural components of the approach?
Research Question 5: Which experimental design characteristics and quality indicators were present in the studies?
Research Question 6: To what extent was implementation of the NI approach associated with children acquiring, generalizing, or maintaining skills?

Method

Inclusion and Exclusion Criteria

For a study to be included in the review, it had to meet five screening criteria. First, the study had to be empirically based research focused on implementation of a NI approach. Second, the study had to be published in a peer-reviewed journal. Third, the study had to include at least one child with a disability who was between the ages of 36 and 60 months at the beginning of the study. Fourth, the study had to report outcome data on child learning. Fifth, the instruction reported in the study had to be implemented in the context of typically occurring activities, routines, or transitions of preschool classrooms. Studies were eligible for inclusion if the instruction was implemented in either an inclusive or early childhood special education classroom. Studies focused on NI approaches conducted in settings other than a preschool classroom were not eligible for inclusion. We acknowledge the importance of early childhood inclusion and recommended child-focused practices that emphasize service provision in natural learning environments (Division for Early Childhood/National Association for the Education of Young Children [DEC/NAEYC], 2009). We chose to include studies conducted in segregated classrooms, given that NI approaches have been used in both inclusive and segregated settings.

Article Search

The process used to identify potential studies for the review involved four stages. In the first stage, an electronic search of articles published between 1980 and 2013 was conducted using all the databases in EBSCO Host and Web of Science, and four databases in Wilson Web (i.e., Education Full Text, Education Index Retro, ERIC, Social Science Full Text). Combinations of the following search terms or truncated search terms using asterisks were used: embed*, transition-based, natural*, incidental, activity-based, milieu/enhanced milieu, responsive interaction, individualized curriculum sequencing, strateg*, instruction/intervention/teaching, and presc*.

In the second stage, an ancestral hand search was conducted of the reference lists of all articles that met the inclusion criteria from an initial screening. A reference list for a funded grant focused on embedded instruction in early learning written by several of the present study co-authors was reviewed to verify all eligible studies appearing on the list were identified through the electronic or ancestral searches. In the third stage, names of researchers whose intervention studies focused on NI approaches in early childhood settings were used as search terms using the search engines described previously. The researcher's last name and first initial were used to conduct the search. In the fourth stage, studies identified through the ancestral search, grant reference list, and name search not previously identified in the electronic search were searched in EBSCO Host database to generate additional indexing or search terms. These terms were used to conduct an additional database search using EBSCO Host. Terms included language, teaching, preschool, imitation, and disabilit*.

Two searches using these procedures were conducted. The first search was conducted in October 2009 (to identify articles published between 1980 and 2008) and the second in May 2013 (to identify articles published after 2008). The first search was conducted in preparation for a potential efficacy trial focused on embedded instruction conducted by several of the present study authors. The second search was conducted after the potential efficacy trial was completed.

Initial Screening

The four-stage process resulted in 1,013 unique articles. The abstract of each unique article identified through the search process was screened by two of the present study authors who were doctoral students at the time the study was conducted and the first author using a project-developed screening form that was created based on the five inclusion and exclusion criteria described previously. When an abstract did not contain sufficient information to make an inclusion or exclusion decision, the full article was obtained and reviewed.

The screening processes resulted in 37 articles that met the inclusion criteria. The primary reasons for exclusion of many articles were as follows: (a) They did not involve implementation of a NI approach, (b) the NI approach was not implemented in a classroom, or (c) the study did not include child outcome data. Two secondary coders who were doctoral-level students independently screened 54% of all abstracts (i.e., 549 articles) to ensure accuracy and consistency of the screening. Interrater agreement for screening criteria was calculated by dividing the number of agreements by the number of agreements plus disagreements and then multiplying by 100. Interrater agreement for the screening was 99.6%.

The 37 articles that met all inclusion criteria are shown with asterisks in the references. Of these 37 articles, 5 included multiple case studies or experiments (Fox & Hanline, 1993; Grisham-Brown, Pretti-Frontczak, Hawkins, & Winchell, 2009; Halle, Baer, & Spradlin, 1981; Horn, Lieber, Li, Sandall, & Schwartz, 2000; Peck, Killen, & Baumgart, 1989). When an article included more than 1 case study or experiment, each case study or experiment had to meet inclusion criteria to be included. Across these 5 articles, 12 case studies or experiments were reported; 11 met the inclusion criteria. Thus, the present review was 43 studies from 37 articles.

Review Procedures

The article review process involved three steps. First, a coding form to review identified studies was developed by the first two authors. Second, coders were trained to use the coding form before they began reviewing the studies included in the present review. Third, coders were asked to read each study in its entirety and extract information using the coding form.

Coding form. The coding form included seven sections. We used the first section to record the term used to characterize the NI approach and the purpose of the study. The second section was used to record information about the attributes of child and adult participants. The next two sections were used to record information about the contexts and conditions under which the NI approach was implemented (e.g., study setting, types of activities) and the procedural components of the NI approach intervention (e.g., content of targeted skills, instructional procedures, dose of intervention). The fifth section was used to record information with respect to key characteristics of the experimental design and quality indicators (e.g., research design, measurement of dependent variable, treatment fidelity). The quality of single-case design (SCD) studies was evaluated using standards derived from the What Works Clearinghouse SCD technical documentation (Kratochwill et al., 2010) and quality indicators for SCD outlined by Horner and colleagues (2005). The quality of group experimental designs was evaluated using nine standards derived from essential and desirable quality indicators for group experimental and quasi-experimental research studies

(Gersten et al., 2005). In the sixth section, information was recorded about child outcomes (i.e., skill acquisition, generalization, and maintenance). In the last section of the coding form, information about the definition or key features of the NI approach as described by the study authors was recorded, including which of the four features of NI were described as being part of the intervention.

Training the coders. Following the development of the coding form, the first two authors developed a manual that included operational definitions and examples for codes. In addition to the first two authors, a third doctoral-level coder was trained. Prior to coding, all coders reviewed the manual, coded a practice article, discussed agreements and disagreements, and received feedback from the first or second author. Each coded at least three additional articles and received feedback on their coding until agreement met or exceeded 80%.

Interrater agreement for coding. After all coders met the agreement criterion for training, one coder coded all studies that met the inclusion criteria (i.e., 43 studies). To evaluate accuracy and consistency of primary coding, a secondary coder independently coded 28% of the studies (i.e., 12 studies) using the coding form. Interrater agreement was calculated by dividing the number of agreements for each code by the number of agreements plus disagreements and then multiplying by 100. Interrater agreement was 96% (range = 94%-100%). Disagreements between coders were resolved through reviewing the articles and discussions with the first author.

Results

The 43 studies that met the inclusion criteria were published from 1981 through 2013. Eight studies were conducted in the 1980s, 12 studies in the 1990s, 19 studies from 2000 to 2009, and 4 studies from 2010 to 2013. Forty studies were SCDs; 3 were group experimental designs.

Terms Used to Refer to NI Approach

Across the 43 studies, six different terms were used to characterize the NI approach: *embedded instruction* (*n* = 15), *naturalistic teaching* (*n* = 14), *milieu teaching* (*n* = 5), *transition-based teaching* (*n* = 3), *activity-based intervention* (*n* = 3), and *individualized curriculum sequencing model* (*n* = 1). A definition for each approach based on seminal work is shown in Table 1. We characterized two studies as using a *combined approach* because the authors described the intervention as including naturalistic and direct instruction.

Purposes and Conditions Under Which NI Was Implemented

Study purpose. Thirty-nine of 43 studies were designed to investigate child outcomes associated with the intervention agents' use of the NI approach. In the remaining 4 studies, the primary purpose was to evaluate fidelity of implementation by the intervention agents, although child outcomes were reported (Harjusola-Webb & Robbins, 2012; Mudd & Wolery, 1987; Schepis, Ownbey, Parsons, & Reid, 2000; Schepis, Reid, Ownbey, & Parsons, 2001).

In 6 of 43 studies, a secondary purpose was to compare instructional approaches or instructional formats. Three studies compared activity-based intervention with direct instruction (Apache, 2005; Botts, Losardo, Tillery, & Werts, 2014; Losardo & Bricker, 1994). One study compared milieu teaching with responsive interaction (Yoder et al., 1995) and another compared small group or one-to-one massed-trial instructional format with a distributed-trial format (Wolery, Doyle, Gast, Ault, & Simpson, 1993). McDonnell (1996) compared instructional trial formats: massed practice only versus massed practice and distributed practice.

Table 1. Definition of Each Naturalistic Instructional Approach From Seminal Work.

Approach	Definition
EI (Snyder, Hemmeter, McLean, Sandall, & McLaughlin, 2013)	Approach that emphasizes identifying preferred times and activities when intentional and systematic instructional procedures for teaching a child's priority learning targets are implemented in typically occurring activities, routines, and transitions
NT (Rule, Losardo, Dinnebeil, Kaiser, & Rowland, 1998)	Approach that emphasizes the delivery of instruction in natural settings, utilizes embedded-distributed trials that follow the child's lead, and use of reinforcement indicated by the child's preferences
MT (Kaiser, 1993; Kaiser, Yoder, & Keetz, 1992)	Approach that uses naturalistic, conversation-based teaching procedures in which the child's interest in the environment is used as a basis for eliciting elaborated child communicative responses
TBT (Werts, Wolery, Holcombe-Ligon, Vassilaros, & Billings, 1992)	Approach in which a brief instructional trial to elicit a target behavior is implemented at the beginning of a transition from one activity to another to use time spent in transitions for instruction
ABI (Bricker & Cripe, 1992; Pretti-Frontczak & Bricker, 2004)	Approach that uses child-directed transactions, embeds children's individual goals and objectives in routine, planned, or child-initiated activities and uses logically occurring antecedents and consequences to develop functional and generative skills
ICS (Mulligan, Guess, Holvoet, & Brown, 1980)	Approach that provides multiple opportunities for children to respond to natural antecedents and consequences by embedding the targeted skills for instruction across a variety of activities, materials, settings, instructors, and responses, all of which occur in natural environment

Note. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based intervention/activity-based instruction; ICS = individualized curriculum sequencing model.

Study settings. Forty-two studies explicitly identified the type of preschool setting in which the NI approaches were implemented. In 37 studies, the intervention was implemented in either inclusive (non–Head Start), segregated, or Head Start classrooms. In 5 studies, the intervention was implemented in more than one type of setting. Twenty-six studies were implemented only in one classroom, whereas 16 studies were implemented in more than one classroom. Across all studies, NI approaches were implemented in 43 inclusive, non–Head Start early childhood settings in 29 studies; 18 segregated classrooms in 12 studies; and 12 Head Start classrooms in 5 studies. Wolery et al. (1993) reported that the intervention was implemented in a private preschool classroom, but did not specify whether the setting was inclusive or segregated. Table 2 shows settings by each NI approach.

Activities, routines, and transitions. Intervention agents implemented NI approaches within only one activity in 18 studies, within two activities in 9 studies, within three or more activities in 11 studies, and reportedly during all classroom activities or routines in 5 studies. Across the 43 studies, authors reported that instruction was most often delivered in center-time activities ($n = 14$), free-play activities ($n = 13$), meal routines ($n = 11$), and small-group activities ($n = 9$). Table 2 shows the activities in which the authors reported that the instruction was implemented by each NI approach.

Attributes of Study Participants

Child participants. Two hundred eleven preschool children with disabilities participated in the 43 studies. Data reported below are for these 211 children. Three studies included 26 children

Table 2. Percentages for Key Study Features by Naturalistic Instructional Approach.

| | Naturalistic instructional approach | | | | | | |
| | EI | NT | MT | TBT | ABI | ICS | Com |
Feature	(*n* = 15)	(*n* = 14)	(*n* = 5)	(*n* = 3)	(*n* = 3)	(*n* = 1)	(*n* = 2)
Setting[a]							
Inclusive	87	71	40	33	67	0	50
Self-contained	13	14	100	33	33	100	0
Head Start	1	14	0	0	0	0	100
Activities[b]							
Free-play	0	50	80	0	0	0	100
Center	60	29	0	0	0	0	50
Small group	27	7	40	0	33	100	0
Circle	7	14	60	0	33	0	50
Large group	27	0	0	0	33	100	0
Other activities[c]	0	14	40	0	67	100	0
Routines							
Meal times	13	36	40	0	0	100	50
Other routines[d]	27	7	0	0	0	100	0
Transitions	0	0	0	100	0	0	50

Note. n refers to number of studies by approach. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based instruction; ICS = individualized curriculum sequencing model; Com = combined approach.
[a]In some studies, the intervention was implemented in more than one type of setting, so total percentages do not sum to 100.
[b]In some studies, the intervention was implemented in more than one classroom activity, routine, or transition, so total percentages do not sum to 100. Activity type was coded as described by the study authors.
[c]Other activities included gross motor, art, table, one-to-one, work area activities, and activities in playground, gym, and hallway.
[d]Other routines included grooming, bathroom/diapering, arrival, nap, and unspecified morning and natural routines.

without disabilities (Culatta, Kovarsky, Theadore, Franklin, & Timler, 2003; Grisham-Brown et al., 2009; Grisham-Brown, Ridgley, Pretti-Frontczak, Litt, & Nielson, 2006). Demographic data and data on child learning outcomes for these 26 children were not included in the present review. In addition, data for 4 children from the McDonnell (1996) study were excluded because these participants were either enrolled in kindergarten or primary grades at study entry.

Child gender was reported for 201 of 211 children (135 males, 66 females). The mean ages of children with disabilities were reported in 38 studies (*M* = 51.5 months, *SD* = 7.8), and children's individual ages and age ranges were reported in 39 studies (range = 24-84 months).

For type of disability, 96 children were characterized as developmentally delayed or at risk for developmental delay. Other disability categories reported were speech and language delay (*n* = 48), autism spectrum disorder (*n* = 36), Down syndrome (*n* = 12), cerebral palsy (*n* = 5), multiple disabilities (*n* = 5; for example, deaf-blind, intellectual and physical disabilities), other disabilities (*n* = 7; for example, 13-q syndrome, attention deficit and hyperactivity disorder, mental retardation) and delays-unspecified (*n* = 2). Table 3 shows information about child gender, age, and type of disability by each NI approach.

For ethnicity, only 5 of 43 studies reported these data for 16 participating children. These 16 children were White (*n* = 12), Black (*n* = 2), and Latino (*n* = 2). Data on socioeconomic status (SES) were reported in only 3 studies for 14 children. Eleven of 14 children were from families of low SES; 3 were from families characterized as middle class.

Table 3. Percentages of Study Participant Attributes by Naturalistic Instructional Approach.

	Naturalistic instructional approach						
	EI	NT[a]	MT	TBT	ABI	ICS	Com
Attribute	(*n* = 40)	(*n* = 64)	(*n* = 45)	(*n* = 11)	(*n* = 39)	(*n* = 2)	(*n* = 10)
Child gender							
Male	73	58	64	82	56	100	70
Female	27	27	36	18	44	0	30
Child mean age at study entry (in months)[b]	54.3	49.5	49.9	54.4	53.0	35.5	54.3
Child disability category							
Developmental delay or at risk	25	13	80	36	87	100	20
Speech-language delay	18	41	4	27	13	0	50
Autism spectrum disorder	28	27	13	0	0	0	20
Down syndrome	5	14	0	0	0	0	10
Other[c]	25	6	2	36	0	0	0
	EI	NT	MT	TBT	ABI	ICS	Com
	(*n* = 30)	(*n* = 51)	(*n* = 19)	(*n* = 7)	(*n* = 6)	(*n* = 3)	(*n* = 6)
Intervention agent role							
Teacher	30	45	68	86	0	100	50
Assistant teacher	7	8	11	0	0	0	0
Paraprofessional	30	27	21	0	0	0	0
Graduate student/researcher	17	12	0	0	67	0	0
Other[d]	17	8	0	14	33	0	50

Note. n refers to the total number of children who participated in studies by approach or the total number of intervention agents who participated in studies by approach. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based instruction; ICS = individualized curriculum sequencing model; Com = combined approach.
[a]In Kohler, Strain, Hoyson, and Jamieson's (1997) NT study, data on gender were not reported for 10 children, thus, percentage for gender for NT approach does not sum to 100.
[b]Mean age was calculated based on the number of children for whom mean age data were reported.
[c]Other includes cerebral palsy, multiple disabilities, other disabilities, and delays-unspecified.
[d]Other intervention providers include therapists, personal assistants, special education teachers, and undergraduate students.

NI agents. Across the 43 studies, a total of 122 adults implemented the NI approach. Based on the professional role of the adults, as characterized by study authors, NI was implemented by 57 preschool teachers, 27 teacher aids, 8 assistant teachers, 15 researcher/graduate students, 7 therapists, 4 personal assistants, 3 undergraduate students, and 1 special education teacher. Table 3 shows the intervention agents' role by each NI approach.

Researchers reported information regarding the gender of intervention agents in 13 studies, age in 8 studies, and ethnicity in 1 study. For the 13 studies that reported gender, 35 participants were female and 2 participants were male. For the 8 studies that reported age, intervention agents ranged in age from 20 to 55 years with a mean age of 30 years (*SD* = 4.8).

Information about the intervention agents' level of education was provided in 19 studies. These studies included 51 interventionists who had or were working toward a bachelor's degree or higher, 3 with an associate's degree, 5 who either held or were working toward a high school diploma or equivalent, and 1 with a Child Development Associate credential. In 18 studies,

researchers reported information about the teaching experiences of intervention agents. Teaching experience ranged from no experience to 22 years with a mean experience of 7.7 years (*SD* = 5.7).

Features and Components of NI Approach

Overview of the four features. Each study was analyzed to determine whether the authors reported implementing the four features of NI approaches described by Rule et al. (1998). All 43 studies were implemented in classroom environments during ongoing activities (consistent with inclusion criteria) and addressed skills that appeared to support children's participation. Although following the child's lead is a distinguishing feature of NI approaches, only 25 of 43 studies explicitly stated that instruction was implemented by following the child's lead. In 17 studies, the authors explicitly described that naturally occurring or logically planned consequences followed the child's behavior. In 35 studies, intervention agents were those who interacted regularly with participating children. Overall, in 10 studies, the implementation of the NI approach was reported with sufficient detail to conclude the intervention included the four features described above. Four of these 10 studies were characterized by the authors as naturalistic teaching, 4 as milieu teaching, and 2 as embedded instruction. Although only 10 studies explicitly described that all four features of NI approaches were implemented, we chose to summarize findings from all studies that met study inclusion criteria because we did not know whether these four features were not implemented or just not described. Tables 4 and 5 show these 10 studies along with all other studies reviewed.

Skills targeted for instruction. We used two different categorization systems to group skills targeted for instruction: by developmental domains or by type of skill outcomes. For developmental domain categorization, we grouped targeted skills under one of six categories: preacademic, social, communication, motor, adaptive, and cognition. Across 42 studies in which researchers reported the targeted skills, 26 addressed one or more target skills from communication, 17 addressed preacademic skills, 8 addressed social skills, 8 addressed motor skills, 4 addressed adaptive skills, and 1 addressed a cognitive skill.

For type of skill outcome, instructional targets were grouped under four categories: dispositions (e.g., persistence), chains of behaviors (e.g., washing hands), discrete responses (e.g., naming colors), and response classes (e.g., imitating peers). Across the 43 studies, researchers investigated the influence of NI approaches on discrete behaviors in 26 studies, response classes in 14 studies, and chained behaviors in 13 studies. Dispositions were not investigated in any study. Table 6 shows categories addressed by each NI approach.

Target skill selection. The procedures used to select target skills were reported in 42 studies. In some studies, researchers used more than one strategy to identify target skills. Skills were selected from participating children's individualized educational programs in 16 studies, based on assessment results in 9 studies, based on teacher interview in 7 studies, and based on parent interview in 3 studies. In 14 studies, researchers reported that target skills were selected based on their presumed importance for the preschool children participating in each study. In 7 studies, researchers reported that the skills selected were those that were not in participating children's repertoires (i.e., had not been acquired).

Instructional procedures. Forty-two of the 43 reviewed studies reported the instructional procedures used as part of the NI approach. Based on the description of the procedures provided, as shown in Table 7, we organized them under three major categories: planned environmental arrangements, adult- or peer-mediated instructional procedures, or other. Planned environmental arrangements involve "engineering" the learning environment or modifying learning activities to

Table 4. Experimental Design and Quality Indicators for Single-Case Experimental Design Studies by Naturalistic Instructional Approach.

Study by approach	Design[a]	Participant description[b]		Mani. of IV[e,f]	Measurement of treatment fidelity[b]		DV measured repeatedly[f,i]	IOA[f,j]		At least three attempts[f,m]	3+ data points/phase[f,n]
		Child[c]	Adult[d]		% S[g]	F ≥ 80%[h]		% S[k]	≥80%[l]		
Embedded instruction											
1. Neef, Walters, and Egel (1984)[o]	Ia	2	1	✓	0		✓	✓	✓	✓	3
2. Venn et al. (1993)	Ia	2	1	✓	2	✓	✓	✓	✓	✓	3
3. Grisham-Brown, Schuster, Hemmeter, and Collins (2000)	Ia	2	1	✓	2	✓	✓	✓	✓	✓	2
4. Horn, Lieber, Li, Sandall, and Schwartz (2000) S1	Ib	2	1	✓	0		✓	✓	✓	✓	2
5. Horn et al. (2000) S2	Ia	1	1	✓	0		✓	✓	✓		2
6. Horn et al. (2000) S3	3	2	1	✓	0		✓	✓	✓		2
7. Daugherty, Grisham-Brown, and Hemmeter (2001)	Ib	2	1	✓	2	✓	✓	✓	✓	✓	2
8. Schepis, Reid, Ownbey, and Parsons (2001)	Ia	2	2	✓	3	✓	✓	✓	✓		1
9. Johnston, Nelson, Evans, and Palazolo (2003)[o]	Ia	2	1	✓	2	✓	✓	✓	✓	✓	2
10. Grisham-Brown, Ridgley, Pretti-Frontczak, Litt, and Nielson (2006)	Ia	1	1	✓	3	✓	✓	✓	✓	✓	2
11. Macy and Bricker (2007)	3	2	1	✓	0		✓	✓	✓	✓	2
12. Grisham-Brown, Pretti-Frontczak, Hawkins, and Winchell (2009) S1	Ia	1	1	✓	2	✓	✓	✓	✓	✓	2

(continued)

10

Table 4. (continued)

Study by approach	Design[a]	Participant description[b]		Mani. of IV[e,f]	Measurement of treatment fidelity[b]		DV measured repeatedly[f,i]	IOA[f,j]		At least three attempts[f,m]	3+ data points/phase[f,n]
		Child[c]	Adult[d]		% S[g]	F ≥ 80%[h]		% S[k]	≥80%[l]		
13. Grisham-Brown et al. (2009) S2	Ia	1	1	✓	2		✓	✓	✓	✓	2
14. Grisham-Brown et al. (2009) S3	Ia	1	1	✓	2	✓	✓	✓	✓		2
15. Toelken and Miltenberger (2012)	Ib	2	1	✓	0		✓	✓	✓	✓	2
Naturalistic teaching											
1. Halle, Baer, and Spradlin (1981)°	Ia	1	1	✓	0		✓	✓	✓	✓	3
2. Warren, McQuarter, and Rogers-Warren (1984)	Ia	2	1	✓	0		✓		✓	✓	3
3. Cavallaro and Poulson (1985)°	Ib	2	1	✓	0		✓	✓	✓	✓[p]	2
4. Mudd and Wolery (1987)	Ia	2	2	✓	2	✓	✓	✓	✓		2
5. Peck, Killen, and Baumgart (1989) S1	Ia	2	1	✓	3	✓	✓	✓	✓	✓	3
6. Peck et al. (1989) S2	Ia	2	1	✓	3	✓	✓	✓	✓	✓[p]	3
7. Fox and Hanline (1993) S1	Ib	2	1	✓	1	✓	✓	✓	✓	✓	3
8. Fox and Hanline (1993) S2	Ib	2	1	✓	0		✓	✓	✓	✓	2
9. McDonnell (1996)	2	2	1	✓	1	✓	✓	✓	✓	✓	1
10. Kohler, Strain, Hoyson, and Jamieson (1997)	Ic	1	1	✓	0		✓	✓	✓	✓	3
11. Malmskog and McDonnell (1999)	Ia	2	1	✓	3	✓	✓	✓	✓	✓	2

(continued)

11

Table 4. (continued)

Study by approach	Design[a]	Participant description[b]		Mani. of IV[e,f]	Measurement of treatment fidelity[b]		DV measured repeatedly[f,i]	IOA[f,j]		At least three attempts[f,m]	3+ data points/phase[f,n]
		Child[c]	Adult[d]		% S[g]	F ≥ 80%[h]		% S[k]	≥80%[l]		
12. Schepis, Ownbey, Parsons, and Reid (2000)°	Ia	2	2	✓	3	✓	✓	✓	✓		2
13. Kohler, Anthony, Steighner, and Hoyson (2001)°	Ia	2	1	✓	2	✓	✓	✓	✓	✓	3
14. Harjusola-Webb and Robbins (2012)	Ia	2	2	✓	0		✓	✓	✓		3
Milieu teaching											
1. Kaczmarek, Hepting, and Dzubak (1996)°	Ib	2	1	✓	3	✓	✓	✓	✓	✓	2
2. McCathren (2000)	Ib	2	1	✓	0		✓	✓	✓	✓	2
3. Olive et al. (2007)°	Ia	2	1	✓	2	✓	✓	✓	✓	✓	2
4. Christensen-Sandfort and Whinnery (2013)°	Ia	2	1	✓	1	✓	✓	✓	✓	✓	2
Transition-based teaching											
1. Werts, Wolery, Holcombe-Ligon, Vassilaros, and Billings (1992)	Ib	3	1	✓	1	✓	✓		✓	✓	4
2. Wolery, Doyle, Gast, Ault, and Simpson (1993)	Ib	2	1	✓	2	✓	✓	✓	✓	✓	2
3. Wolery, Anthony, and Heckathorn (1998)	4	3	3	✓	0		✓	✓	✓	✓	3
Activity-based intervention											
1. Losardo and Bricker (1994)	2	2	1	✓	2	✓	✓	✓	✓	✓	2
2. Botts, Losardo, Tillery, and Werts (2014)	2	1	1	✓	3	✓	✓	✓	✓	✓	2

(continued)

12

Table 4. (continued)

Study by approach	Design[a]	Participant description[b] Child[c]	Participant description[b] Adult[d]	Mani. of IV[e,f]	Measurement of treatment fidelity[b] % S[g]	Measurement of treatment fidelity[b] F ≥ 80%[h]	DV measured repeatedly[f,i]	IOA[f,j] % S[k]	IOA[f,j] ≥80%[l]	At least three attempts[f,m]	3+ data points/phase[f,n]
Individualized curriculum sequencing model											
1. Bambara, Warren, and Komisar (1988)	1b	2	1	✓	0		✓		✓	✓[p]	3
Combined approach											
1. McBride and Schwartz (2003)	1a	2	2	✓	3	✓	✓	✓	✓	✓	2

[a]Design categories: 1a = *multiple baseline across participants*, 1b = *multiple baseline across behaviors*, 1c = *multiple baseline across settings*, 2 = *alternating treatment*, 3 = *AB*, and 4 = *Other* (combination of withdrawal and multiple baseline across participants).

[b]Quality indicators from Horner et al. (2005).

[c]1 = *Study reports one or two of the following variables: gender, age, or functioning*, 2 = *Study reports gender, age, and functioning*, and 3 = *Study reports gender, age, functioning, disability category, ethnicity, and socioeconomic status.*

[d]1 = *Study reports one or two of the following variables: gender, age, or role*, 2 = *Study reports gender, age, or level of education*, 3 = *Study reports gender, age, ethnicity, role, level of education, and teaching experience.*

[e]Manipulation of independent variable.

[f]Indicators from WWC single-case technical documentation (Kratochwill et al., 2010).

[g]Percentage of intervention sessions for which treatment fidelity data were reported. 0 = *fidelity not reported*, 1 = *fidelity reported for less than 20% of intervention sessions*, 2 = *fidelity reported for 20% to 32% of intervention sessions*, and 3 = *fidelity reported for at least 33% of intervention sessions.*

[h]Mean treatment fidelity reported was 80% or greater.

[i]Dependent variable measured repeatedly.

[j]IOA = interobserver agreement.

[k]IOA reported for at least 20% of sessions across conditions.

[l]Mean IOA reported was at least 80%.

[m]The study had three or more attempts to demonstrate experimental effect.

[n]1 = *less than three data points/phase*, 2 = *3 to 4 data points/phase*, 3 = *5 or more data points/phase*, and 4 = *not clear based on information provided.*

[o]Indicates studies in which implementation of the naturalistic instructional approach was reported with sufficient details to conclude the intervention included the four features of naturalistic instruction described by Rule, Losardo, Dinnebeil, Kaiser, and Rowland (1998).

[p]Indicates fewer than three attempts for some participants in the study.

13

Table 5. Quality of Group Experimental Design Studies (*n* = 3).

Studies	Random assignment	Comparable groups	Treatment and control described	Treatment fidelity reported	Multiple outcome measures	Reliability of outcomes	Validity of outcome measures	Effect size reported	Attrition <30%
Milieu teaching									
I. Yoder et al. (1995)[a]		✓	✓	✓	✓	✓		✓	
Activity-based intervention									
I. Apache (2005)	✓		✓			✓	✓	✓	
Combined approach									
I. Culatta, Kovarsky, Theadore, Franklin, and Timler (2003)		✓	✓	✓		✓		✓	

[a]Indicates the study in which implementation of the naturalistic instructional approach was reported with sufficient details to conclude the intervention included the four features of naturalistic instruction described by Rule, Losardo, Dinnebeil, Kaiser, and Rowland (1998).

Table 6. Percentages of Target Skills Addressed From Developmental Domain or Type of Skill by Approach.

	Naturalistic instructional approach						
	EI	NT	MT	TBT	ABI	ICS	Com
	(*n* = 15)	(*n* = 14)	(*n* = 5)	(*n* = 3)	(*n* = 3)	(*n* = 1)	(*n* = 2)
Developmental domain							
Preacademic	47	36	0	100	0	100	50
Social	13	36	0	0	0	0	50
Communication	27	71	100	67	67	100	100
Motor	20	21	0	0	33	100	0
Adaptive	13	14	0	0	0	0	0
Cognitive	7	0	0	0	0	0	0
Type of skill							
Disposition	0	0	0	0	0	0	0
Behavior chain	53	29	0	0	33	0	0
Discrete response	60	57	60	100	33	100	50
Response class	33	36	40	0	33	0	50

Note. n refers to number of studies by approach. Some studies addressed target skills from more than one category. Total percentages, therefore, might not sum to 100. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based instruction; ICS = individualized curriculum sequencing model; Com = combined approach.

set the occasion for an embedded learning trial during a typically occurring activity (e.g., placing a cup out of reach during snack routine to set the occasion for a child to use a single-word utterance [e.g., "cup"] to gain access to the cup). Adult- or peer-mediated instructional procedures are those that specify a precise instructional sequence that should be followed for the embedded learning trial and typically include a prompt or prompt-fading strategy, a target behavior or approximation, and the provision of explicit feedback or consequence (e.g., mand-model, incidental teaching, system-of-least prompts, constant time delay). The "other" category included procedures that did not meet the operational definitions for the previous two categories (e.g., visual support). Across 43 studies, one or more planned environmental arrangement procedures were used in 16 studies, one or more adult- or peer-mediated instructional procedures were used in 39 studies, and one other strategy was used in 2 studies. Table 7 shows the three categories and details the instructional procedures used for the adult- or peer-mediated category in the reviewed studies by NI approach.

Dose. Thirty-three studies provided information about the dose of intervention. The number of instructional trials or opportunities delivered to a participating child in an intervention session was reported in 21 studies and ranged from 3 to 20 trials per target skill (*M* = 7.2). The duration of an intervention session was reported in 18 studies and ranged from 5 min to 180 min (*M* = 23.3). When a study reported a range for the duration of intervention sessions, the lower number was used to calculate the mean duration of intervention sessions across studies. The number of intervention sessions conducted in a day was reported in 13 studies and ranged from 1 to 3 sessions (*M* = 1.5 sessions/day). In 5 studies, the total duration was reported for the intervention or intervention phase and ranged from 6 to 30 weeks (*M* = 13).

For the 21 studies that reported the number of instruction trials provided in each intervention session, the number of trials or opportunities provided varied across instructional approaches. The mean number of instructional trials per target skill in each session was 9.2 in the 5 naturalistic

Table 7. Percentages of Studies That Reported Implementing an Instructional Procedure by Approach.

| | Naturalistic instructional approach | | | | | | |
| | EI | NT | MT | TBT | ABI | ICS | Com |
Instructional procedure	(*n* = 15)	(*n* = 14)	(*n* = 5)	(*n* = 3)	(*n* = 2[a])	(*n* = 1)	(*n* = 2)
Planned environmental arrangements							
Environmental arrangements	47	29	60	0	50	0	50
Curricular modifications	40	0	0	0	0	0	50
Adult- or peer-mediated[b] instructional procedures							
Incidental teaching	0	7	40	0	0	0	0
Elaboration or expansion	0	14	20	0	0	0	0
Mand or model[c]	40	29	80	0	0	0	50
Constant time delay	40	0	0	67	50	0	0
Progressive time delay	7	0	0	33	0	0	0
Time delay (unspecified)	7	29	60	0	0	0	0
System-of-least prompts	20	21	0	0	0	100	0
Most to least prompts	7	0	20	0	0	0	0
Simultaneous prompting	7	0	0	0	0	0	0
Prompts (unspecified)	33	29	20	0	0	0	0
Feedback or consequence strategies	27	29	20	0	0	0	0
Antecedent strategies	0	0	0	0	100	0	0
Other	7[d]	0	0	0	0	0	50[e]

Note. n refers to total number of studies for each approach. More than one instructional procedure could be used in a study, so total percentages by approach do not sum to 100. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based instruction; ICS = individualized curriculum sequencing model; Com = combined approach.
[a]One activity-based intervention study (Apache, 2005) did not provide specific information about instructional procedures used with children. Percentages reported in the table are based on two of three ABI studies in which information about instructional procedures was provided.
[b]No studies implemented peer-mediated instructional procedures; one study encouraged peer interaction during teaching episodes but is not reflected in the listed procedures.
[c]Mand or Model refers to mand-model, mand only, or model only.
[d]Other EI procedures refer to visual supports.
[e]Other Com procedures refer to discrete trial.

teaching studies, 6 in the 10 embedded instruction studies, 3.7 in the 3 transition-based teaching studies, 3 in the 1 milieu teaching study, and 12 in the individualized curriculum sequencing model study. In an activity-based intervention study (Losardo & Bricker, 1994), 20 instructional opportunities were presented to children in each intervention session.

The mean length of intervention sessions varied across each NI approach. The mean length of intervention sessions was 65 min (range = 5-180 min) for three embedded instruction studies, 21.7 min for three activity-based intervention studies (range = 15-30 min), 12.5 min (range = 10-20 min) for eight naturalistic teaching studies, and 10 min (range = 5-15 min) for three milieu teaching studies.

Experimental Design Characteristics and Quality Indicators

Research methods and designs. The designs used in the 40 SCD studies were multiple baseline across participants (*n* = 22), behaviors (*n* = 11), and settings (*n* = 1); alternating treatments (*n* = 3); and AB (*n* = 2). One study used both a withdrawal and a multiple baseline across participants

design (Wolery, Anthony, & Heckathorn, 1998). Table 4 shows experimental designs employed in each SCD study by NI approach. The three group experimental studies were two-group pre-test/posttest (*n* = 2; Apache, 2005; Yoder et al., 1995) and a quasi-experimental crossover design (Culatta et al., 2003).

Quality indicators for SCD studies. Table 4 shows experimental design features and quality indicators present in the 40 SCD studies. In the table, numeric and letter combinations for designs refer to categories of different SCDs. Data for each quality indicator in Table 4 are shown by a check mark or a numeric value of 0, 1, 2, or 3. The check mark indicates that the dimension of quality for the indicator was met. The numeric value refers to a continuum of quality for the indicator (i.e., higher number associated with higher quality for the indicator). Information about each quality indicator evaluated is provided in the table notes. Below, we summarize information for each quality indicator across the reviewed studies.

Sufficient description of participants. Two of 40 studies reported sufficient information (i.e., gender, age, functioning, disability category, ethnicity, and SES) to directly replicate the studies with similar participants. Thirty provided information about gender, age, and functioning of child participants. In 8 studies, demographic information reported for children was very limited.

For adult participants (i.e., intervention agents), one study reported gender, age, ethnicity, role, level of education, and teaching experience, and five studies reported gender, age, role, and level of education. Thirty-four studies provided limited information about intervention agents.

Manipulation of independent variable and measurement of treatment fidelity. Across all 40 SCD studies, the independent variable(s) was systematically manipulated with the researcher(s) determining how to implement phase or condition changes. Treatment fidelity data were reported in 25 of 40 studies, and mean treatment fidelity was 80% or greater in 24 of these studies. Only 9 of 25 studies reported that treatment fidelity data were collected for at least 33% of the intervention sessions.

Treatment fidelity data were collected by direct observation using a procedural checklist in 25 studies and reported as the percentage of procedures implemented. Of 25 studies in which a direct observation method was used to collect treatment fidelity data, 23 reported the mean treatment fidelity scores. Across these 23 studies, mean treatment fidelity was 93% (range of means = 70%-100%) during the intervention phase of the study.

We analyzed further the 25 studies that used a direct observation method to collect fidelity data by reading the description of the fidelity checklist used in the study. Each study was coded as belonging to one of three categories: (a) description of fidelity checklist items included procedural components associated with an instructional trial (e.g., "present stimulus and attending cue, secure attention, present the task direction; wait the appropriate interval, provide the model, provide appropriate consequence, provide correct inter-trial interval"), (b) description of fidelity checklist items included "generic" statements (e.g., "fidelity measure included the major components and features of activity-based intervention and direct instruction"), or (c) description of fidelity checklist items was not provided. Across these 25 studies, 16 used a fidelity checklist including procedural components associated with an instructional trial, 5 used generic statements to describe fidelity checklist items, and 5 studies reported treatment fidelity data but did not provide information about the fidelity checklist items.

Measurement of dependent variable. The dependent variable(s) was repeatedly measured across all 40 studies by more than one observer. Thirty-nine used behavioral observations and 1 used both behavioral observations and standardized assessments (Macy & Bricker, 2007) to measure child outcomes. In the studies in which behavioral observations were used to evaluate children's

performance, researchers conducted live observation in 34 studies and videotaped the sessions in 6 studies. Across these 40 studies, 14 reported the length of the dependent measures in data collection session, which ranged from 5 to 30 min with an overall mean of 13.9 min. When behavioral observations were used as dependent measures, researchers reported data using various metrics. These included reporting percentage of correct responses ($n = 23$), the frequency with which a target behavior occurred ($n = 8$), the rate at which the target behavior occurred ($n = 4$), the percentage of intervals in which a target behavior occurred ($n = 4$), and rating of level of child independence ($n = 1$).

Interobserver agreement (IOA). IOA data were reported in each study, and the reported mean IOA was 80% or greater across all studies. Of 40 studies, the IOA data were reported for at least 20% of sessions across condition in 32 studies. In 8 studies, the IOA was reported for less than 20% of the sessions across conditions.

IOA was reported using percentage agreement in 39 studies and a generalizability coefficient in 1 study (McCathren, 2000). Across the 39 studies that used percentage agreement to report IOA, 36 reported the mean IOA on child behaviors. Mean IOA ranged from 80% to 100% with an overall mean of 95% during the intervention phase.

Demonstration of experimental effect. Thirty-three of 40 SCD studies included at least three attempts to demonstrate an experimental effect on child learning outcomes at three different points in time or with three different phase repetitions. For the number of data points in each study phase (excluding generalization or maintenance), each phase included 5 or more data points in 12 studies, 3 or 4 data points in 25 studies, and fewer than 3 data points in 2 studies.

Quality indicators for group experimental design studies. Table 5 shows the quality indicators for each group experimental design study by approach. Overall, none of the studies met all nine standards. Two studies met five of nine standards (Culatta et al., 2003; Yoder et al., 1995), and one study met four of nine standards (Apache, 2005). Three standards, adequate description of treatment and comparison conditions, reporting reliability for outcome measures, and reporting effect sizes or adequate information to calculate effect sizes, were met by all three studies. Standards with respect to comparable groups and treatment fidelity were met by two studies (Culatta et al., 2003; Yoder et al., 1995). Standards regarding random assignment, use of multiple outcome measures, and providing evidence for validity of outcome measures were each met by one study. Attrition was not reported in any of the three studies.

Relationships Between Intervention and Child Outcomes

We coded whether authors reported implementation of the NI approach was functionally related to skill acquisition, generalization, or maintenance. Table 8 shows the percentages of studies reporting acquisition, generalization, and maintenance data for children and the percentage of children who acquired, generalized, or maintained target skills by each approach.

Skill acquisition. Data on skill acquisition were reported for all 211 preschool children with disabilities in 43 studies. Only 5 of 43 studies reported skill acquisition data in relation to a preidentified criterion. Positive skill acquisition outcomes associated with the use of NI approaches were reported for a total of 207 of the 211 young children with disabilities. Based on the visual analysis of data reported in the studies or descriptions provided by the authors, 189 had improved performance during or after intervention over their baseline performance (e.g., increase in number/percentage of correct response) and 16 children acquired targeted skills as measured by reaching a specified criterion (i.e., predetermined level of performance; for example, 83% correct

Table 8. Percentages of Child Outcomes by Approach.

	Naturalistic instructional approach						
	EI	NT	MT	TBT	ABI	ICS	Com
	(*n* = 15)	(*n* = 14)	(*n* = 5)	(*n* = 3)	(*n* = 3)	(*n* = 1)	(*n* = 2)
Studies reporting							
Skill acquisition	100	100	100	100	100	100	100
Generalization	40	36	40	67	67	100	0
Maintenance	40	50	40	67	67	100	0
	EI	NT	MT	TBT	ABI	ICS	Com
	(*n* = 40)	(*n* = 64)	(*n* = 45)	(*n* = 11)	(*n* = 39)	(*n* = 2)	(*n* = 10)
Results[a]							
Skill acquisition	100/98	100/100	100/100	100/100	100/100	100/100	100/70
Generalization	35/30	17/16	11/11	64/64	28/28	100/100	0
Maintenance	38/35	38/33	11/11	36/27	28/28	100/100	0

Note. n for studies reporting skill acquisition, generalization, and maintenance refers to total number of studies by approach. *n* for results refers to total number of children who participated in studies by approach. EI = embedded instruction; NT = naturalistic teaching; MT = milieu teaching; TBT = transition-based teaching; ABI = activity-based instruction; ICS = individualized curriculum sequencing model; Com = combined approach.
[a]Results shown as % of children for whom data reported per percentage of children with positive outcomes.

responding for two consecutive intervention sessions). Two children did not reach criteria (i.e., 80% or 100% accuracy for 2 or 3 days across 2 studies) but demonstrated increases in their percentages of correct responses.

Four children with disabilities did not demonstrate acquisition of targeted skills in relation to an intervention provider's use of a NI approach. In the Culatta et al. (2003) study, three children with disabilities did not demonstrate the target skills independently after instruction was provided using naturalistic teaching. In the Grisham-Brown et al. (2000) study, one participating child's percentage of correct responses did not increase above baseline levels after embedded instruction was initiated.

Generalization. Generalization data were reported for 50 children in 18 studies. These included generalization data across settings (*n* = 15), materials (*n* = 4), people (*n* = 3), and responses (*n* = 1). Across these 18 studies, authors reported some type of evidence that 47 of these children generalized the skills they learned.

Maintenance. Maintenance data were reported for 61 participating children across 20 studies. Of the studies reporting maintenance data, 9 provided information about when maintenance data were collected. On average, the last maintenance probe was conducted 3.1 weeks after the intervention ended or when the target children reached acquisition criterion (range = 1-20 weeks). Fifty-six of the 61 children demonstrated targeted skills during maintenance probe sessions.

Discussion

The purposes of this systematic review were to characterize descriptively the empirical literature focused on NI approaches on several important dimensions relevant for implementing these approaches and to examine the extent to which quality indicators for single-case experimental

and group experimental designs were reflected in the reviewed studies. A total of 37 articles that included 43 studies met the inclusion criteria and were analyzed using an investigator-developed coding system. In the following sections, we discuss findings of the present study with respect to each research question, present delimitations and limitations of the present review, and offer implications for future research and practice.

Terms Used to Characterize NI Approaches

Six named NI approaches were identified in the empirical literature: (a) naturalistic teaching, (b) embedded instruction, (c) activity-based intervention, (d) milieu teaching, (e) transition-based teaching, and (f) individualized curriculum sequencing model. The most common term used in the reviewed studies was *embedded instruction*, followed by *naturalistic teaching*. The findings related to the terms used most often to refer to the approach were not unexpected, given the explicit emphasis in these approaches on embedding instruction during typically occurring activities using naturalistic teaching strategies.

Conditions Under Which Studies Were Conducted

The majority of studies were conducted in inclusive settings, consistent with recommendations that NI approaches should be used to support the access and participation of young children with disabilities in these settings (DEC/NAEYC, 2009). Across the reviewed studies, instruction was embedded in a variety of child-initiated and adult-directed activities. From the information provided in the reviewed studies about how learning targets were selected, it was difficult to determine whether targets were designed to promote situated learning opportunities and functional skills children would need to participate more fully in typically occurring activities (Dunst et al., 2001) or to promote general skill development.

Few studies described identifying a logical "fit" between the content of the learning target and the activity, routine, or transition in which instruction was embedded. Contemporary conceptualizations suggest that it is important to assess child, environment, and activity "fit" when making decisions about what to teach and when to teach when using NI approaches (Snyder et al., 2013). Future studies should provide additional specificity about the conditions under which NI approaches are implemented, particularly with respect to why a particular skill is taught in a designated activity or activities. This would further advance knowledge about the conditions under which NI approaches are likely to be effective by elucidating whether naturally occurring motivational variables for the target behavior are present.

Attributes of Study Participants

Studies included in the present review involved young children with a variety of disabilities and 79% of the intervention agents were adults who regularly interacted with participating children. These findings suggest that the research on NI approaches is distinguished by its frequent implementation in typical practice settings by "authentic" providers with children from the population of preschool children with disabilities.

Detailed information about the attributes of study participants was not provided in the majority of studies. Goldstein (2002) reported similar findings related to limitations in the reporting of participant attribute data in his review of 60 studies focused on communication interventions for children with autism. He and others (Gersten et al., 2005; Horner et al., 2005) have emphasized the need for developing a set of conventions to standardize the sharing of descriptive information about study participants, including both child participants and individuals who implement the intervention. Future research should include sufficient descriptions of adult and child participants

(e.g., ethnicity, English language learner, age, gender, level of education, years of experience, functional abilities) to identify the characteristics of intervention agents who can implement NI approaches with fidelity and the attributes of children for whom the NI approaches are effective.

Four Features of NI

Across the reviewed studies, four features of NI approaches highlighted in the extant literature were not always explicitly described, although there was some evidence that these features were present. Only 23% of the studies explicitly described implementation of all four features of NI. Because various terms are used to refer to NI approaches, explicitly describing how the four "naturalistic" features are implemented will be important for advancing the knowledge base about this evidence-based practice, particularly when these approaches are compared with other instructional approaches that do not have most or all of these features.

Key Procedural Components

We characterized procedural components in the present study by examining what content was emphasized in a naturalistic teaching episode, where teaching episodes occurred, and which instructional procedures were used during teaching episodes. Specifying and operationally defining the procedural components of the NI approach is important for at least two reasons. First, it facilitates systematic or direct replication. Second, it permits comparative analyses about components that are or are not delivered across approaches with similar or distinct features. Comparative analyses facilitate the identification of key or active ingredients and the examination of relative efficacy or effectiveness of components in relation to child learning outcomes (Hulleman & Cordray, 2009).

With respect to content emphasized, we found that learning targets were largely focused on communication or preacademic skills. Moreover, the majority of skills included in learning targets were discrete skills or focused on chained behaviors. As Wolery and Hemmeter (2011) noted, additional research is needed to determine which types of skills are most efficiently and effectively taught using NI approaches, particularly given a child's phase and pace of learning and the characteristics of the activities in which the child participates.

In the majority of the reviewed studies, teaching episodes occurred primarily in one or two classroom activities, routines, or transitions. In addition, there was variation in where teaching episodes occurred depending on the NI approach that was implemented. For example, teaching episodes in the majority of embedded instruction, naturalistic teaching, and milieu teaching studies were implemented during free-play or center-time activities, while teaching episodes occurred only during transitions between activities (as would be expected) in transition-based teaching. The findings related to embedded instruction, naturalistic teaching, and milieu teaching were somewhat unexpected, given the emphasis in NI approaches on providing embedded learning opportunities across a variety of activities. Perhaps this finding can be explained by challenges associated with collecting data in preschool classrooms in ways that reflect the complex nature of where teaching episodes occur in relation to the classroom schedule. Documenting teaching episodes occurring across numerous activities would require significant resources for data collection and analysis, which has likely led most researchers to identify one or two activities in which to evaluate implementation of teaching episodes.

Even descriptive studies that have quantified where preschool teachers have provided embedded teaching episodes on priority learning targets have limited observations to an average of 86 min (Pretti-Frontczak & Bricker, 2001) or 20 min (Noh, Allen, & Squires, 2009), which does not capture an entire preschool day and might not permit observations during different types of

activities (e.g., child-initiated, teacher-directed, routines, transitions). Future research might focus on systematically collecting data across various categories of activities that occur during the preschool day, characterizing more precisely when teaching episodes occur during these activities, and examining child learning outcomes in relation to the types of activities in which instruction occurred.

When examining the instructional procedures used to create embedded learning opportunities, we identified two major categories of procedures: (a) environmental arrangements and (b) adult- or peer-mediated systematic instructional procedures (e.g., constant time delay, system-of-least prompts). Instructional procedures were reportedly selected based on their appropriateness for teaching the skills targeted for intervention. For example, when motor or adaptive skills were targeted, the instructional procedure used typically was the system-of-least prompts. When language skills were addressed, environmental arrangements, mand, or modeling procedures were used, or were used in combination with one another. In 18 studies, some of the instructional procedures used were not described sufficiently to permit an understanding of the components of embedded learning trials (i.e., the nature and relationships among the antecedents, behaviors, and consequences). To advance knowledge about intentional and systematic learning trials, researchers should name the instructional procedures used in future studies with particular attention to the logical antecedents, consequences, and error corrections (when appropriate) used in these procedures, which result in complete learning trials for children (VanDerHeyden et al., 2005).

Intensity of treatment is related to the dose of intervention implemented. The features of dose (i.e., rate, length, and distribution), dose frequency (i.e., number of times an intervention is provided per day or per week), and total duration of the intervention or intervention phase were represented in less than half the studies. Treatment intensity varied widely across the studies in which it was reported. Given the limited information reported in the reviewed studies, it was not possible to calculate mean cumulative intervention intensity either for all 43 studies or for studies associated with each NI approach. To advance reporting practices, researchers might consider specifying cumulative intervention intensity and dose form using the definitions provided by Warren, Fey, and Yoder (2007). In addition, these authors have advocated for the conduct of research focused on promising intervention approaches (e.g., NI) that examine relative efficacy and effectiveness under varied treatment intensities. Although 6 studies in the present review compared different instructional approaches, only 1 study focused explicitly on examining select aspects of differential treatment intensity specified by Warren et al (McDonnell, 1996). McDonnell compared NI for three communication targets per child providing the same cumulative intervention intensity for each participant but varying the dose of instructional episodes by comparing 30 massed trials per session with 15 massed and 15 distributed trials per session. Findings showed minimal child-specific differences in the relative effectiveness of the two dose formats. With the exception of the McDonnell study, our overall finding about treatment intensity is consistent with the assertion of Warren et al. that these types of comparative studies are rare in the early intervention (and NI) literature.

Experimental Design Characteristics and Quality Indicators

Using quality indicators derived from the What Works Clearinghouse (2010) and Horner et al. (2005), none of the 40 SCD studies met all quality indicators at the highest levels included in the coding system. There were only 2 studies that provided sufficient information about child participants. Both these studies were transition-based teaching studies. Only 1 study provided sufficient information about adult intervention agents, and this study was also a transition-based teaching study. Although the independent variable(s) was systematically manipulated in all 40 SCD studies, fewer than one fourth reported treatment fidelity data for at least 33% of the intervention sessions. Data reported in the reviewed studies generally indicated that procedures were being

implemented as planned, although most fidelity data were not derived from detailed observations or recordings of teaching episodes. Findings in the present review are consistent with previous reviews that have examined the reporting of treatment integrity data (Armstrong, Ehrhardt, Cool, & Poling, 1997; Wheeler, Baggett, Fox, & Blevins, 2006). Although the importance of collecting and reporting treatment fidelity data has been repeatedly emphasized (e.g., Gresham, Gansle, & Noell, 1993; LeLaurin & Wolery, 1992; McIntyre, Gresham, DiGennaro, & Reed, 2007), findings from our review suggest the continuing need for improved data collection and reporting practices.

Serial collection of dependent measures of child performance related to targeted skills occurred in all 40 SCD studies, and IOA data were collected for at least 20% of sessions across conditions in 32 studies. When behavioral observations were used as dependent measures, the metrics used to quantify child performance varied widely. Although different metrics can be selected for use within individual studies to quantify functional relationships, the use of different child performance metrics across studies makes it difficult to integrate and summarize findings without the use of result interpretation aids such as effect-size estimates. Effect-size estimates for SCD, however, are less developed than those for group experimental designs, and there are not yet uniformly agreed-upon methods or standards for these estimations (Kratochwill et al., 2010).

The majority of the studies (90%) included at least three attempts to demonstrate an experimental effect at three different points in time with a single participant or across three different participants, and 93% of the studies included at least three data points in each phase. These quality indicator findings are particularly important for supporting inferences about functional relationships between implementation of NI and child performance and learning.

None of the three group experimental research studies met all nine quality standards used in our review. Methodological strengths of the three studies included adequate description of treatment and control conditions, reporting reliability for outcome measures and reporting effect sizes or sufficient information to calculate effect sizes. All other indicators were met by either one or two studies with the exception of providing information about attrition, which was not included in any of the studies.

Child Outcomes

Regarding child outcomes, findings suggest that NI approaches resulted in acquisition of targeted skills for almost all young children with disabilities enrolled in the studies. The exceptions were the 2 studies that used a combined approach, with only 70% of the children having positive skill acquisition outcomes. The 18 studies reporting generalization data showed some children generalized skills across different settings, materials, and people, although generalization data were less robust for embedded instruction relative to other NI approaches. In the 20 studies that evaluated maintenance, most children maintained skills over time, although maintenance data were less robust for transition-based teaching relative to other NI approaches.

Findings with respect to skill acquisition are quite promising. Several issues remain to be addressed, however, about relationships between implementation of NI approaches and child learning outcomes. First, given that primary benefits of NI approaches described in the literature include generalization and maintenance of learned skills, the finding that fewer than 50% of published studies included generalization and maintenance data was unexpected. Nevertheless, these findings are consistent with those of Hepting and Goldstein (1996), who reported that only 56% of studies included in their systematic literature review focused on naturalistic language intervention included generalization data. Second, although 43 studies reported skill acquisition data, only 6 specified an acquisition criterion, which limits comparisons about the robustness of child outcomes across studies absent calculating effect sizes. Third, the limited comparative data related to skill acquisition limit inferences related to the efficiency and effectiveness of NI

approaches when compared with other instructional approaches (e.g., direct instruction) or differential treatment intensity.

Although our review highlights the important work that has established a foundational evidence base for NI approaches in relation to skill acquisition, additional research is needed to evaluate which NI approaches are most effective for which children and under what conditions. For example, future research might reveal NI approaches to be relatively less efficient for skill acquisition on certain types of learning targets (e.g., preacademic) but relatively more efficient when a learning target focuses on a functional communication, social, or adaptive skill that is used across people, settings, or materials and over time.

Delimitations and Limitations

The present review is delimited by its focus on NI approaches implemented in preschool classrooms during typically occurring activities and with preschool children with or at risk for disabilities or delays. We did not evaluate studies focused on implementation of these approaches in clinic-based settings, in families' homes, or in isolated locations in the classroom. Space limitations imposed by journals or the choices made by researchers about which study design features or procedural components to include in published work likely affected the summary data reported in this review.

Implications for Future Reporting and for Practice

Findings from the present review suggest several implications for future reporting practices. First, naming and defining the NI approach implemented and reporting the core components or active ingredients of the approach are critical for "unpacking" the key procedural components. Sufficiently describing these procedural components would allow comparative evaluations across NI approaches and improved understanding about relationships between NI implementation and child learning outcomes. At a minimum, researchers should describe how the four features that distinguish NI approaches were operationalized in the study. Second, participant attributes, treatment fidelity, and treatment intensity data should be reported in sufficient detail to permit replication and the examination of functional relationships among study participants, intervention implementation, intervention intensity, and child learning outcomes. Third, child generalization and maintenance data should be collected and reported, given the emphasis placed on these two learning outcomes in the NI literature. Fourth, researchers should gather social validity data to inform evaluations about which components of NI approaches practitioners believe are feasible, acceptable, and useful to implement in typically occurring activities in preschool classrooms. In the present review, only 5 of 43 studies reported such data. Despite these findings, the case for "subjective measurement" remains relevant and important (cf. Wolf, 1978).

Findings from the present review extend the contributions from a review of naturalistic language interventions conducted by Hepting and Goldstein (1996). First, our review focuses on NI approaches, including embedded instruction, described in the empirical literature through 2013 versus naturalistic *language* intervention approaches. Second, we examined NI approaches used to support child learning across several outcome areas, including communication. At least one finding from the present review is consistent with the finding reported by Hepting and Goldstein. Across both reviews, it was challenging to identify the specific procedural components of the naturalistic language intervention or NI approach implemented. This finding persists in the literature despite Rule et al.'s (1998) guidelines related to describing precisely independent and dependent variables focused on NI.

Efforts to identify evidence-based practices have provided an impetus for attending to higher quality standards in both the conduct and reporting of research, including more transparent ways

to judge the rigor and quality of group experimental and SCD studies. These developments might motivate researchers to attend to comprehensive sets of quality reporting indicators (cf. Goldstein, Lackey, & Schneider, 2014). With adoption of refinements in research methods and reporting practices, more explicit documentation related to implementation and outcomes from NI approaches should occur.

The research studies reviewed in this article offer evidence that NI is reliably associated with young children with disabilities acquiring targeted skills. As additional evidence for NI approaches continues to accumulate, the field will likely need to identify effective and efficient professional development strategies for supporting practitioners' fidelity of implementation of these approaches. Practitioners will need to learn about the key features and practices of NI (e.g., what to teach, when to teach, how to teach, how to evaluate implementation of instruction and child learning outcomes). They will likely benefit from implementation support about how to make informed decisions about the children for whom these approaches are most likely to be effective and under what conditions instruction should be provided.

Authors' Note

Salih Rakap is now at Ondokuz Mayis University, Tara W. McLaughlin is now at Massey University, and Mary E. McLean is now at the University of Florida. The opinions expressed are those of the authors, not the funding agency.

Declaration of Conflicting Interests

Funding

References

*Studies that met all inclusion criteria.

*Apache, R. R. G. (2005). Activity-based intervention in motor skill development. *Perceptual & Motor Skills*, *100*, 1011-1020.

Armstrong, K. J., Ehrhardt, K. E., Cool, R. T., & Poling, A. (1997). Social validity and treatment integrity data: Reporting in articles published in the *Journal of Developmental and Physical Disabilities*, 1991-1995. *Journal of Developmental and Physical Disabilities*, *9*, 359-367.

*Bambara, L. M., Warren, S. F., & Komisar, S. (1988). The individualized curriculum sequencing model: Effects on skill acquisition and generalization. *Journal of the Association for Persons With Severe Handicaps*, *13*, 8-19.

*Botts, D. C., Losardo, A. S., Tillery, C. Y., & Werts, M. G. (2014). A comparison of activity-based intervention and embedded direct instruction when teaching emergent literacy skills. *The Journal of Special Education*, *48*, 120-134. doi:10.1177/0022466912449652

Bricker, D., & Cripe, J. (1992). *An activity-based approach to early intervention*. Baltimore, MD: Brookes.

*Cavallaro, C. C., & Poulson, C. L. (1985). Teaching language to handicapped children in natural settings. *Education & Treatment of Children*, *8*, 1-24.

*Christensen-Sandfort, R. J., & Whinnery, S. B. (2013). Impact of milieu teaching on communication skills of young children with autism spectrum disorders. *Topics in Early Childhood Special Education*, *32*, 211-222.

Cook, B. G., & Odom, S. L. (2013). Evidence-based practices and implementation science in special education. *Exceptional Children*, *79*, 135-144.

*Culatta, B., Kovarsky, D., Theadore, G., Franklin, A., & Timler, G. (2003). Quantitative and qualitative documentation of early literacy instruction. *American Journal of Speech-Language Pathology*, *12*, 172-188.

*Daugherty, S., Grisham-Brown, J., & Hemmeter, M. L. (2001). The effects of embedded skill instruction on the acquisition of target and nontarget skills in preschoolers with developmental delays. *Topics in Early Childhood Special Education*, *21*, 213-221.

Division for Early Childhood. (2014). *DEC recommended practices in early intervention/early childhood special education*. Retrieved from http://www.dec-sped.org/recommendedpractices

Division for Early Childhood/National Association for the Education of Young Children. (2009). *Early childhood inclusion: A joint position statement of the Division for Early Childhood (DEC) and the National Association for the Education of Young Children (NAEYC)*. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute.

Dunst, C. J., Bruder, M. B., Trivette, C. M., Hamby, D. W., Raab, M., & McLean, M. (2001). Characteristics and consequences of everyday natural learning opportunities. *Topics in Early Childhood Special Education*, *21*, 68-92.

*Fox, L., & Hanline, M. F. (1993). A preliminary evaluation of learning within developmentally appropriate early childhood settings. *Topics in Early Childhood Special Education*, *13*, 308-327.

Gersten, R., Fuchs, L. S., Compton, D., Coyne, M., Greenwood, C., & Innocenti, M. (2005). Quality indicators for group experimental and quasi-experimental research in special education. *Exceptional Children*, *71*, 149-164.

Goldstein, H. (2002). Communication intervention for children with autism: A review of treatment efficacy. *Journal of Autism and Developmental Disorders*, *32*, 373-396.

Goldstein, H., Lackey, K. C., & Schneider, N. J. B. (2014). A new framework for systematic reviews: Application to social skills interventions for preschoolers with autism. *Exceptional Children*, *80*, 262-286. doi:10.1177/0014402914522423

Gresham, F. M., Gansle, K. A., & Noell, G. H. (1993). Treatment integrity in applied behavior analysis with children. *Journal of Applied Behavior Analysis*, *26*, 257-263.

*Grisham-Brown, J., Pretti-Frontczak, K., Hawkins, S. R., & Winchell, B. N. (2009). Addressing early learning standards for all children within blended preschool classrooms. *Topics in Early Childhood Special Education*, *29*, 131-142.

*Grisham-Brown, J., Ridgley, R., Pretti-Frontczak, K., Litt, C., & Nielson, A. (2006). Promoting positive learning outcomes for young children in inclusive classrooms: A preliminary study of children's progress toward pre-writing standards. *Journal of Early and Intensive Behavior Intervention*, *3*, 171-190.

*Grisham-Brown, J., Schuster, J. W., Hemmeter, M. L., & Collins, B. C. (2000). Using an embedding strategy to teach preschoolers with significant disabilities. *Journal of Behavioral Education*, *10*, 139-162.

*Halle, J. W., Baer, D. M., & Spradlin, J. E. (1981). Teachers' generalized use of delay as a stimulus control procedure to increase language use in handicapped children. *Journal of Applied Behavior Analysis*, *14*, 389-409.

*Harjusola-Webb, S., & Robbins, S. H. (2012). The effects of teacher-implemented naturalistic intervention on the communication of preschoolers with autism. *Topics in Early Childhood*, *32*, 99-110.

Hart, B. M., & Risley, T. R. (1975). Incidental teaching of language in the preschool. *Journal of Applied Behavior Analysis*, *8*, 411-420.

Hemmeter, M. L. (2000). Classroom-based interventions: Evaluating the past and looking toward the future. *Topics in Early Childhood Special Education*, *20*, 56-61.

Hepting, N. H., & Goldstein, H. (1996). What's natural about naturalistic language intervention? *Journal of Early Intervention*, *20*, 249-265.

Horn, E., & Banerjee, R. (2009). Understanding curriculum modifications and embedded learning opportunities in the context of supporting all children's success. *Language, Speech, and Hearing Services in Schools*, *40*, 406-415.

*Horn, E., Lieber, J., Li, S., Sandall, S., & Schwartz, I. (2000). Supporting young children's IEP goals in inclusive settings through embedded learning opportunities. *Topics in Early Childhood Special Education*, *20*, 208-223.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, *71*, 165-180.

Hulleman, C. S., & Cordray, D. S. (2009). Moving from the lab to the field: The role of fidelity and achieved relative intervention strength. *Journal of Research on Educational Effectiveness*, *2*, 88-110.

*Johnston, S., Nelson, C., Evans, J., & Palazolo, K. (2003). The use of visual supports in teaching young children with autism spectrum disorder to initiate interactions. *Augmentative and Alternative Communication*, *19*, 86-103.

*Kaczmarek, L. A., Hepting, N. H., & Dzubak, M. (1996). Examining the generalization of milieu language objectives in situations requiring listener preparatory behaviors. *Topics in Early Childhood Special Education*, *16*, 139-167.

Kaiser, A. P. (1993). Parent-implemented language intervention: An environmental perspective. In A. P. Kaiser & D. B. Gray (Eds.), *Enhancing children's communication: Research foundations for intervention* (pp. 63-84). Baltimore, MD: Brookes.

Kaiser, A. P., & Trent, J. A. (2009). Communication intervention for young children with disabilities: Naturalistic approaches to promoting development. In S. L. Odom, R. H. Horner, M. E. Snell, & J. Blacher (Eds.), *Handbook of developmental disabilities* (pp. 224-245). New York, NY: Guilford Press.

Kaiser, A. P., Yoder, P. J., & Keetz, A. (1992). The efficacy of milieu teaching. In S. F. Warren & J. Reichle (Eds.), *Causes and effects in communication and language intervention* (pp. 63-84). Baltimore, MD: Brookes.

*Kohler, F. W., Anthony, L. J., Steighner, S. A., & Hoyson, M. (2001). Teaching social interaction skills in the integrated preschool: An examination of naturalistic tactics. *Topics in Early Childhood Special Education*, *21*, 103-113.

*Kohler, F. W., Strain, P. S., Hoyson, M., & Jamieson, B. (1997). Merging naturalistic teaching and peer-based strategies to address the IEP objectives of preschoolers with autism: An examination of structural and child behavior outcomes. *Focus on Autism and Other Developmental Disabilities*, *12*, 196-206.

Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M, & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf

LeLaurin, K., & Wolery, M. (1992). Research standards in early intervention: Defining, describing, and measuring the independent variable. *Journal of Early Intervention*, *16*, 275-287.

*Losardo, A., & Bricker, D. (1994). Activity-based intervention and direct instruction: A comparison study. *American Journal on Mental Retardation*, *98*, 744-765.

*Macy, M. G., & Bricker, D. D. (2007). Embedding individualized social goals into routine activities in inclusive early childhood classrooms. *Early Child Development and Care*, *177*, 107-120.

*Malmskog, S., & McDonnell, A. P. (1999). Teacher-mediated facilitation of engagement by children with developmental delays in inclusive preschools. *Topics in Early Childhood Special Education*, *19*, 203-216.

*McBride, B. J., & Schwartz, I. S. (2003). Effects of teaching early interventionists to use discrete trials during ongoing classroom activities. *Topics in Early Childhood Special Education*, *23*, 5-17.

*McCathren, R. B. (2000). Teacher-implemented prelinguistic communication intervention. *Focus on Autism and Other Developmental Disabilities*, *15*, 21-29.

*McDonnell, A. P. (1996). The acquisition, transfer, and generalization of requests by young children with severe disabilities. *Education & Training in Mental Retardation & Developmental Disabilities*, *31*, 213-234.

McIntyre, L. L., Gresham, F. M., DiGennaro, F. D., & Reed, D. D. (2007). Treatment integrity of school-based interventions with children in the *Journal of Applied Behavior Analysis* 1991-2005. *Journal of Applied Behavior Analysis*, *40*, 659-672.

*Mudd, J. M., & Wolery, M. (1987). Training Head Start teachers to use incidental teaching. *Journal of the Division for Early Childhood*, *11*, 124-133.

Mulligan, M., Guess, D., Holvoet, J., & Brown, F. (1980). The individualized curriculum sequencing model (I): Implications from research on massed, distributed, or spaced trial training. *Journal of the Association for the Severely Handicapped*, *5*, 325-336.

*Neef, N. A., Walters, J., & Egel, A. L. (1984). Establishing generative yes/no responses in developmentally disabled children. *Journal of Applied Behavior Analysis*, *17*, 453-460.

Noh, J., Allen, D., & Squires, J. (2009). Use of embedded learning opportunities within daily routines by early intervention/early childhood special education teachers. *International Journal of Special Education*, *24*(2), 1-10. Retrieved from http://www.internationaljournalofspecialeducation.com/issues.cfm

Odom, S. L. (2000). Preschool inclusion: What we know and where we go from here. *Topics in Early Childhood Special Education*, *20*, 20-27.

*Olive, M. L., Cruz, B., Davis, T. N., Chan, J. M., Lang, R. B., O'Reilly, M. F., & Dickson, S. M. (2007). The effects of enhanced milieu teaching and a voice output communication aid on the requesting of three children with autism. *Journal of Autism and Developmental Disorders*, *37*, 1505-1513.

*Peck, C. A., Killen, C. C., & Baumgart, D. (1989). Increasing implementation of special education instruction in mainstream preschools: Direct and generalized effects of nondirective consultation. *Journal of Applied Behavior Analysis*, *22*, 197-210.

Pretti-Frontczak, K., & Bricker, D. (2001). Use of the embedding strategy during daily activities by early childhood education and early childhood special education teachers. *Infant & Toddler Intervention: The Transdisciplinary Journal*, *11*, 111-128.

Pretti-Frontczak, K., & Bricker, D. D. (2004). *An activity-based approach to early intervention* (3rd ed.). Baltimore, MD: Brookes.

Rule, S., Losardo, A., Dinnebeil, L. A., Kaiser, A., & Rowland, C. (1998). Research challenges in naturalistic intervention. *Journal of Early Intervention*, *21*, 283-293.

*Schepis, M. M., Ownbey, J. B., Parsons, M. B., & Reid, D. H. (2000). Training support staff for teaching young children with disabilities in an inclusive preschool setting. *Journal of Positive Behavior Interventions*, *2*, 170-178.

*Schepis, M. M., Reid, D. H., Ownbey, J., & Parsons, M. B. (2001). Training support staff to embed teaching within natural routines of young children with disabilities in an inclusive preschool. *Journal of Applied Behavior Analysis*, *34*, 313-327.

Snyder, P. (2006). Best available research evidence: Impact on research in early childhood. In V. Buysse & P. W. Wesley (Eds.), *Evidence-based practice in the early childhood field* (pp. 35-70). Washington, DC: Zero to Three.

Snyder, P., Hemmeter, M. L., McLean, M. E., Sandall, S., & McLaughlin, T. (2013). Embedded instruction to support early learning in response-to-intervention frameworks. In V. Buysse & E. Peisner-Feinberg (Eds.), *Handbook of response-to-intervention in early childhood* (pp. 283-298). Baltimore, MD: Brookes.

*Toelken, S., & Miltenberger, R. G. (2012). Increasing independence among children diagnosed with autism using a brief embedded teaching strategy. *Behavioral Interventions*, *27*, 93-104.

VanDerHeyden, A. M., Snyder, P., Smith, A., Sevin, B., & Longwell, J. (2005). Effects of complete learning trials on child engagement. *Topics in Early Childhood Special Education*, *25*, 81-94.

*Venn, M. L., Wolery, M., Werts, M. G., Morris, A., DeCesare, L. D., & Cuffs, M. S. (1993). Embedding instruction in art activities to teach preschoolers with disabilities to imitate their peers. *Early Childhood Research Quarterly*, *8*, 277-294.

Warren, S. F., Fey, M. E., & Yoder, P. J. (2007). Differential treatment intensity research: A missing link to creating optimally effective communication interventions. *Mental Retardation and Developmental Disabilities Research Reviews*, *13*, 70-77.

*Warren, S. F., McQuarter, R. J., & Rogers-Warren, A. P. (1984). The effects of mands and models on the speech of unresponsive language- delayed preschool children. *Journal of Speech and Hearing Disorders*, *49*, 43-52.

*Werts, M. G., Wolery, M., Holcombe-Ligon, A., Vassilaros, M. A., & Billings, S. S. (1992). Efficacy of transition-based teaching with instructive feedback. *Education & Treatment of Children*, *15*, 320-334.

What Works Clearinghouse. (2010). *WWC evidence review protocol for early childhood education interventions for children with disabilities* (Version 2.0). Retrieved from http://ies.ed.gov/ncee/wwc/references/idocviewer/doc.aspx?docid=30

Wheeler, J. J., Baggett, B. A., Fox, J., & Blevins, L. (2006). Treatment integrity: A review of intervention studies conducted with children with autism. *Focus on Autism and Other Developmental Disabilities*, *21*, 45-54.

Wolery, M. (2005). DEC recommended practices: Child-focused practices. In S. Sandall, M. L. Hemmeter, B. J. Smith, & M. E. McLean (Eds.), *DEC recommended practices: A comprehensive guide for practical application in early intervention/early childhood special education* (pp. 71-106). Longmont, CO: Sopris West.

*Wolery, M., Anthony, L., & Heckathorn, J. (1998). Transition-based teaching: Effects on transitions, teachers' behavior, and children's learning. *Journal of Early Intervention*, *21*, 117-131.

*Wolery, M., Doyle, P. M., Gast, D. L., Ault, M. J., & Simpson, S. L. (1993). Comparison of progressive time delay and transition-based teaching with preschoolers who have developmental delays. *Journal of Early Intervention*, *17*, 160-176.

Wolery, M., & Hemmeter, M. L. (2011). Classroom instruction: Background, assumptions, and challenges. *Journal of Early Intervention*, *33*, 371-380.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*, 203-214.

*Yoder, P. J., Kaiser, A. P., Goldstein, H., Alpert, C., Mousetis, L., Kaczmarek, L., & Fischer, R. (1995). An exploratory comparison of milieu teaching and responsive interaction in classroom applications. *Journal of Early Intervention*, *19*, 218-242.