KENTUCKY READING RESEARCH CENTER



Evidence-Based Instructional Practices to Support the Development of Print Awareness and Concepts of Print in Preschool-Aged Children: A Systematic Review

June 15, 2026

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Abstract

Print awareness and concepts about print are foundational understandings required to be able to learn letter-sound correspondence skills which ultimately allow students to decode and read words (National Early Literacy Panel, 2008; Shanahan & Lonigan, 2010). One of the key goals of emergent literacy instruction is to teach preschool-aged children about how print works through building alphabet knowledge, using shared reading to show that the words can be read, and matching letters to sounds and pictures (e.g., A, apple, /a/). This review investigated effective instructional practices that support the development of print awareness and concepts about print in preschool-aged students. Data was collected and analyzed from 21 experimental, correlational, and observational studies and found systematic, explicit and targeted instruction on letter names and sounds, print concepts, and the alphabetic principle impacted student learning. Teachers, researchers, parents / caregivers, and community aides were found to be effective implementers at providing print-based interventions. Shared reading practices with intentional instructional moves around print knowledge (e.g., print concepts, letter sounds, etc.) were found to be effective. Further, relatively short and consistent lessons were found to be effective at teaching preschool students alphabet knowledge, print awareness, and the alphabetic principle.

Introduction and Definitions

In this systematic review, studies were included if they examined a print domain (i.e., the content) through an intervention or an instructional format (i.e., the pedagogy). The review investigated the effectiveness of print-based interventions with the goal of identifying evidence-based strategies to support print knowledge and concepts about print in preschool-aged students. In this section, the print domains are defined; existing print-based interventions are discussed; and barriers to implementing print-based instruction in preschool are presented.

Print Domains

In their summary of the key findings of the 2008 National Early Literacy Panel (NELP) report, Shanahan and Lonigan (2010) identified eleven variables for preschool students that predict the development of later literacy skills. Out of these eleven variables, seven of them were specific to print domains, including the following: a) alphabet knowledge, b) rapid automatized naming of letters / digits, c) writing / writing name, d) concepts about print, e) print knowledge, f) reading readiness, and g) visual processing. The NELP report (2008) and Shanahan and Lonigan (2010) use the term “early literacy skills” which they define as “precursor skills that may presage the development of conventional literacy skills” (Shanahan & Lonigan, 2010, p. 280). Shanahan and Lonigan (2010) refer to “conventional literacy skills” as “skills evident within all literacy practices that are readily recognizable as being necessary or useful components of literacy” and “typical targets of school instruction” (p. 280). The eleven variables, over half of them involving print, they identified are aspects of early literacy skills, also known as emergent literacy, and are correlated with the development of conventional literacy skills typically taught in kindergarten through third grade (e.g., foundational literacy). Conventional or foundational literacy skills include “decoding, fluency, reading comprehension, spelling, [and] writing” (Shanahan & Lonigan, 2010, p. 280). Based on these syntheses, the importance of building print awareness and providing instruction across the print domains to preschool students cannot be understated. Without the foundations of print, children may struggle to gain the conventional literacy skills when they encounter their early elementary years (e.g., K-3).

In the What Works Clearinghouse (WWC) practice guide for preparing young children for school, Burchinal et al. (2022) investigated 47 studies that tested the outcomes on school readiness in early childhood and preschool settings. Out of seven recommendations, they found strong evidence (Tier 1) of two distinct recommendations for children’s literacy outcomes involving print domains, including a) letters and sounds, and b) knowledge of print and knowledge of the world. Their recommendation on building preschool children’s knowledge of letters and sounds was based on an analysis of nine high-quality studies. To carry out this recommendation, they suggest introducing a new letter and its sound starting with familiar letters such as the first letter of students’ names. A focus of this recommendation is to introduce letters and sounds intentionally by teaching a target letter and then giving students time to practice writing that letter, both uppercase and lowercase, and integrating games, small group instruction, and center activities that focus on that target letter and its sound. In addition to

introducing the letters and sounds, another suggestion focuses on providing many opportunities for practice through a variety of materials and activities that allow students to name the letters and their corresponding sounds. This can be accomplished through manipulatives such as letter tiles, forming letters in writing or using materials such as sand or playdough, and reading books with words that highlight the target letter. Another suggestion that can support students' development of alphabet knowledge is to incorporate print throughout the classroom and to interact with it in intentional ways. For example, teachers can label items in the classroom and write out the daily class schedule with students. Allowing students to watch models of how print works (e.g., a teacher writing each letter and naming the sounds they make) can help them make the connections from the graphemes to the phonemes.

In their recommendation that supports the development of print knowledge, Burchinal et al. (2022) suggest using shared book reading to use authentic text to model and teach students how print works and to build letter knowledge. Teachers can select fiction and nonfiction texts to show students print features such as fonts, speech bubbles, and titles. Teachers can also select books with a target letter or alphabet books to model the connection between the letter name, letter sound, and a picture of illustration that starts with that letter and sound (e.g., A, apple, /a/). After shared reading, centers can include games that focus on a target letter and small group activities can offer practice on the target letter and sounds.

For the purposes of this review, the term print domain involves a skill related to print, including alphabet knowledge, concepts of print / print awareness, and alphabetic principle. Table 1 outlines these domains and their definitions.

Table 1. Print Domains and Definitions

Print Domain	Definition
Alphabet knowledge	"Children's competence in accurately and quickly identifying printed letter names and letter sounds" (Roberts, Vadasy, & Sanders, p. 413).
Concepts of print/print awareness	The understanding of how print works and how books are read (e.g., sentences are made up of words and words are made up of letters; direction of how to read print; identifying the book cover, title, author, etc.).
Alphabetic principle	"The insight that print systematically maps speech" (Roberts, Vadasy, & Sanders, p. 414). "The concept that letters are used to represent individual phonemes in the spoken word" (p. Moats & Tolman, 2019, p. 45).

To clarify and simplify the print domains and definitions further, students can know and identify letter names and sounds (i.e., alphabet knowledge) through memorization and practice but not yet have the understanding that those letters are used to make up the sounds in spoken words (i.e., alphabetic principle). The alphabetic principle sits somewhere between children possessing alphabet knowledge and being able to decode words. Concepts of print and print

awareness are used interchangeably in this review to point to the understanding children have and develop around how print works, including how books are read and how we read (e.g., left to right, top to bottom). In their study on prereaders' knowledge about book reading and print awareness, Farry-Thorn and Treiman (2022) found that young prereaders could point out letters and words when reading books with an adult, but that knowledge did not necessarily indicate that they understood that print is what is read. They write, "…children are in the process of learning about the role of print in reading. This is true even though the large majority of our participants could visually distinguish letters and words from pictures and label them as such" (p. 1940). Therefore, it is important to not only teach preschool students' letters and sounds, but to also teach them how print works in the context of reading and in books, which helps them to gain the understanding of the alphabetic principle.

Out of the six emergent literacy skills that were found to have moderate to large effects on later literacy learning (NELP, 2008), three of them involved print (i.e., alphabet knowledge, rapid automatized naming of letters / digits, and writing / writing name). According to Moats and Tolman (2019), RAN "helps predict early reading development, especially fluency, but it is not as good a predictor of early reading acquisition as phonological awareness and knowledge of letter names" (p. 92). Therefore, RAN is not included in the print domains in this review and any study that included naming letter names or sounds at any speed or rate were categorized under alphabet knowledge. Similarly, letter writing or name writing are often used as ways to assess alphabet knowledge, print awareness, and the degree to which they understand the alphabetic principle. Therefore, when studies used letter or name writing, they were categorized under the print domain that best aligned based on the goal of the measure(s).

Emergent Literacy Instruction Focused on Print Domains

In early childhood classrooms, activities include teacher-led whole group and small-group lessons and individual or peer learning centers that integrate choice and play to increase engagement and to deepen understanding. The NELP (2008) meta-analysis found moderate to large effects for code-focused instruction on the later development of foundational literacy skills. Shanahan and Lonigan (2010) summarized the NELP (2008) report and noted that none of the code-focused interventions used whole group instruction; all activities were implemented one-on-one or in small groups with teacher direction. In preschool classrooms, small groups and one-on-one instruction often involve some form of play, whether that is child-initiated free play at centers or stations or adult-guided games in a small group.

In the What Works Clearinghouse (WWC) practice guide for preparing young children for school, Burchinal et al. (2022) offer ten specific ways to carry out the two recommendations that involve print-based instruction. Out of those 10 sub-recommendations, three common themes exist: a) explicitly teach and model how print is used and letter names and sounds; b) provide opportunities for practice and repetition; and c) integrate context and real-life experiences to help students make sense of print and remember the letter-sound correspondences. For example, Burchinal et al. (2022) recommends that teachers can use whole group instruction and shared book reading to explicitly teach a target letter and then provide practice opportunities in

small groups by modeling how to write the target letter and narrating the verbal path to form the letter and then having students practice writing it using sand trays. To integrate context, teachers can incorporate alphabet boxes by choosing known or familiar objects to teach the sound of the target letter (e.g., apple, /a/) and reminding students of a memory they had that starts with the target letter sound (e.g., /t/ for tiger at the zoo).

In these examples of print-based instruction, practice and repetition of letter names, letter sounds, and print concepts can be infused in centers and play-based activities and games; however, the explicit instruction and modeling play a critical role in ensuring students are taught the letter names, sounds, and how print is used to ensure accuracy in their learning.

In addition to print-based instruction, the role that phonological and phonemic awareness plays in preschool students learning alphabet knowledge and the alphabetic principle cannot be understated. Roberts, Vadasy, and Sanders (2019) emphasize the high correlation between alphabet knowledge and phonemic awareness and that they are the two best predictors of reading skills. They write, “Learning how to read words requires both letter and sound knowledge and phonemic awareness, and both accuracy and speed are needed” (p. 574). In this review, however, phonological and phonemic awareness are not included in outcomes as this review is focused on print domains. While those essential emergent literacy skills are not a part of this review, it is important to note that phonological and phonemic awareness skills are critical to students learning how to read and spell.

Barriers To Teaching Evidence-Based Instructional Practices to Support Print Knowledge

Integrating print-based instruction in preschool classrooms can be met with challenges. Some of those barriers can include a) a common philosophy that preschool students are not ready for explicit literacy instruction and incidental learning through play should be the focus; b) a lack of training or professional development for teachers or parents / caregivers; and c) preschool curricula do not focus on literacy outcomes (e.g., Creative Curriculum).

The increase in instructional rigor for children in kindergarten through third grades can put pressure on preschool teachers to ensure their 3-, 4-, and 5-year-old students are prepared to start kindergarten and to keep up with the curricular demands (Campbell, 2021). However, some preschool teachers may not believe that the increased expectations are developmentally appropriate for preschool students. Rachmani (2020) writes, “The early arguments against introducing literacy skills in an ECE setting were based on the theory of ‘reading readiness’ and if reading was introduced too early, children would become frustrated and may be put off reading long-term” (p. 255).

O’Leary and Ehri (2020) also write, “…many early childhood educators have been opposed to the direct teaching of foundation skills such as letters and phonological awareness, which they regard as developmentally inappropriate prior to kindergarten because such instruction is viewed as involving uncreative, boring skill and drill” (p. 75).

Further, Rachmani (2020) cites that research has shown that teachers can teach the necessary emergent literacy skills through fun and creative play-based activities. Burchinal et al. (2022) note a potential obstacle for teachers to implement their research-based recommendations: “My children don’t seem very excited about letters / sounds” (p. 51). They suggest increasing students’ interest and engagement in learning about letters and sounds through connecting letter knowledge to children’s names or things they like. Presenting evidence-based practices to support print knowledge that are both effective and engaging for students can help to shift the views of preschool educators and parents so that students enter kindergarten with the foundational print-based skills needed to prevent future reading struggles and to help them learn to read.

Another barrier to effectively providing print-based instruction in preschool settings is lack of teacher training or resources. In the WWC Practice Guide for Preparing Young Children for School, Burchinal et al. (2022) cite the following potential obstacle that a preschool teacher may provide: “I don’t know what letters or sounds to teach, when to move on, or when to backtrack and spend more time on a letter or sound” (p. 51). To address this obstacle, the panel recommends that teachers start with identifying what children know by assessing the letters and sounds they can name and produce. Then, teachers can group children by their alphabet knowledge and build on what they know and need to learn. Another way to address this challenge is for preschools to adopt a curriculum that includes a scope and sequence and literacy assessments and to provide training for preschool teachers on how to administer the assessments and implement the curriculum.

Lastly, in many preschools across the United States, the chosen curriculum is often not focused on literacy outcomes (Shea et al., 2025). In their study of 98 preschool classrooms, Shea, Piasta, Shen, Hudson, Greeley, Lewis, and Logan (2025) found that non-literacy-focused curricula was more widely used than literacy-focused curricula. They used the term comprehensive curriculum to describe many of the common preschool programs implemented in schools (e.g., Creative Curriculum, High Scope). These curricula are often child-centered, whole-child constructivist approaches to learning where preschool children explore and engage in their environment in a broad manner that favors social interaction, self-exploration, and incidental learning. Shea et al. (2025) write, “…many comprehensive curricula are designed to be broad, child-centered approaches that support multiple domains simultaneously, such breadth may result in fewer gains in any specific domain” (p. 4). For example, literacy objectives are included in Creative Curriculum but the curriculum guides teachers in “infusing” (p. 4) these practices into the environment and teaching the objectives in an implicit manner as opposed to explicitly instructing them. This aligns with much of the critique of whole-language and balanced literacy curricula in early elementary, where children can be engaged in a task that allows them full range of exploration while they were not provided with clear and explicit instruction to meet a literacy learning objective. Similarly, a caution for preschool teachers is to not rely on play-based learning that focuses too much on children learning implicitly through their own exploration of their environment; but, to thoughtfully combine play-based activities with explicit guidance and direction which can lead to more effective outcomes of print-based skills.

Research Questions:

- Research question 1: What evidence-based instructional practices are effective to support the development of print awareness and concepts about print in preschool-aged students?

- Research question 2: What features of the instructional practices (e.g., duration, age, dosage) are associated with improved print domain outcomes? Do these features differ according to student characteristics?

Methodology

Study Eligibility Criteria

Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, literature was identified through a three-step process. First, studies were identified based on key search terms. Next, the titles and abstracts were screened for eligibility. Third, a full-text screening process based on eligibility criteria was implemented. To be included in the review, studies must have met the following criteria: a) at least 50% of the students in the sample were preschool students (e.g., ages 3 or 4, or age 5 not yet in kindergarten); b) an intervention involving one or more of the print domains; c) written in English and the study took place in the United States or its territories, England, Australia, Ireland, New Zealand, or Canada in a school-based setting, public or private, classroom, clinic, home, or early childhood center; and d) at least one outcome involving one of the print domains.

Search Strategy

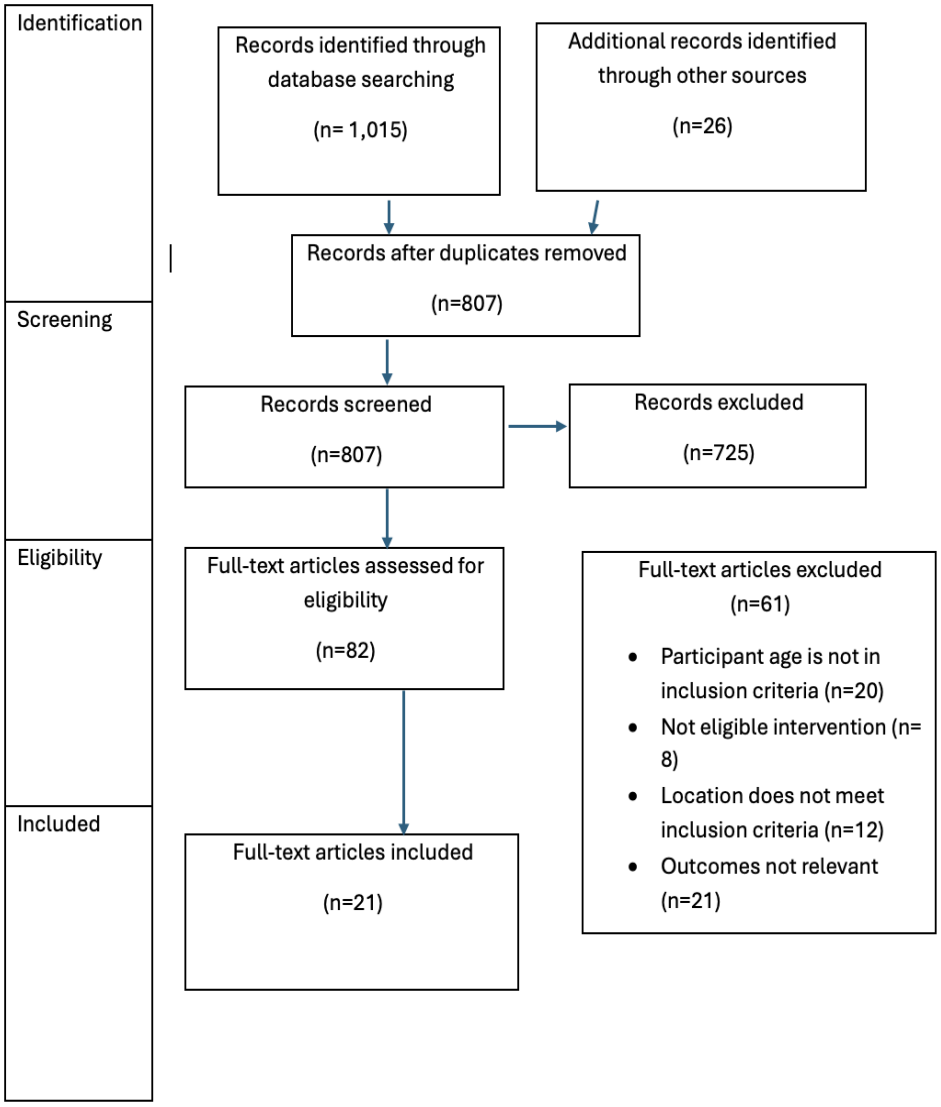
In the identification process, an electronic database search was conducted using the EBSCO interface, the ProQuest interface, and the Web of Science interface. The primary database for EBSCO included ERIC, and the following databases were included: Academic Search Complete, APA PsycINFO, Communication and Mass Media Complete, Education Full Text, Educational Administration Abstracts, Open Dissertations, Psychology and Behavioral Sciences Collection, Social Sciences Abstracts, Sociological Collection, and Teacher Reference Center. The following databases were searched using the ProQuest interface: APA PsycArticles, Education Research Index, Linguistics and Language Behavior Abstracts, ProQuest Dissertation and Theses Global, Publicly Available Content Database, and Sociological Abstracts. The Web of Science Core Collection database with searched within the Web of Science interface.

The search terms were developed based on the following framework: population, concept, and context. The population included preschool teachers and instruction implemented with preschool students, the concept centered on print awareness, and the context focused on instruction. Observational, experimental, and correlational studies were included. Exclusion criteria included the date of publication. Studies must have been published between January 2018 and December 2025 when the search was conducted.

The database search produced 1,015 records. After completing the database search, prior literature reviews and meta-analyses related to print domains and instructional practices were reviewed. The studies in prior reviews were cross-referenced with the studies included for final inclusion and against the inclusion criteria. Twenty-six records were included based on the cross-reference screening process. Once duplicates were removed, 807 records remained. The titles and abstracts of the 807 records were screened for the eligibility criteria and sorted into two categories (“yes” or “no”). From the screening phase of the process, 725 records were excluded leaving 82 eligible for full-text screening.

The 82 records eligible for full-text screening were reviewed and included if they had the following criteria: a) at least 50% of the students in the sample were preschool students (e.g., ages 3 or 4, or age 5 not yet in kindergarten); b) an intervention involving one or more of the print domains; c) written in English and the study took place in the United States or its territories, England, Australia, Ireland, New Zealand, or Canada in a school-based setting, public or private, classroom, clinic, home, or early childhood center; and d) at least one outcome involving one of the print domains. A spreadsheet was used with "yes" or "no" coding; if one criterion was missing, the record was excluded. From this process, 61 records were excluded leaving 21 records to be synthesized in this systematic review. Figure 1 includes a PRISMA diagram that outlines the selection process.

Figure 1. PRISMA diagram



Inclusion and Exclusion Criteria

The following includes a more in-depth description of the eligibility criteria:

1. *Study design:* Included studies used a study design that addressed the research question of identifying evidenced-based instructional practices that are effectively support the development of one or more of the print domains in preschool-aged students. The design must have collected data on student outcomes related to print and how instruction supported those outcomes.

2. *Participant sample/population:* Included studies had at least 50% of the teachers in the sample that taught preschool and the students in the classrooms were preschool students (e.g., ages 3 or 4, or age 5 not yet in kindergarten). Studies with MLL and SWD students were included.

3. *Language and study location:* Included studies were written and conducted in English and the study took place in the United States or its territories, England, Australia, Ireland, New Zealand, or Canada in a school-based setting, public or private, classroom, clinic, home, or early childhood center. Studies with MLL students were included.

4. *Concept:* Included studies involved print instruction, which focused on one or more of the following print domains: letter name knowledge, letter sound knowledge, alphabet knowledge, concepts of print, and alphabetic principle.

5. *Context:* Included studies explained how interventions and instruction supported the development of print domains in preschool-aged students.

Coding Procedure

The 21 records included in the final analysis were coded using a spreadsheet to extract information on the following categories: a) research design; b) instructor / intervention implementer type; c) student demographics and participant information; d) independent variable name and description; e) dependent variable(s) and description; f) effect size and / or findings to show effectiveness; g) fidelity of research; h) instructional setting, and i) dosage including intervention and control / comparison conditions (if applicable).

Analysis

After the 21 studies were coded by extracting the key information, the results were categorized into two tables to synthesize the findings. The first table included the study design, the print domains (e.g., alphabet knowledge, concepts of print, alphabetic principle), the instructional setting (e.g., whole group, small group, etc.) and the specific instructional techniques (e.g., letter-sound instruction, shared book reading, etc.). The second table captured all features of

the print-based interventions and their association with outcomes (e.g., print domain, duration, age, implementer, dosage, etc.).

After the tables were completed, the first table was organized and synthesized into charts to show the frequency of the print domains, the implementer, the instructional tiers, and the instructional techniques implemented. For the second table, the information was transferred into a spreadsheet, and filters and dropdown menus were used to clean the data and to sort and analyze based on outcomes. For example, the studies were sorted by the outcomes of the dependent variables to identify the characteristics of the intervention based on the print domain(s), duration, age, teacher and peer interactions, and dosage that were effective and ineffective. From there, the results were presented based on the outcomes and the effect sizes (if applicable). Once the studies were categorized based on the effectiveness of the intervention in improving print-based outcomes, they were further analyzed to explore the effectiveness for students with disabilities, students at-risk of reading difficulties, English learners / dual language learners, and interventions implemented in Tier 1, 2 and 3 settings and the dosage and implementer. Using the outcome categories of the print domains, the subcategories of student demographics were sorted to identify patterns in the outcomes.

Results

Characteristics of Reviewed Studies

The first research question sought to identify effective instructional practices that support the development of print domains in preschool-aged children in publications from January 2018 and December 2025.

Research Question 1: What evidence-based instructional practices are effective to support the development of print awareness and concepts about print in preschool-aged students?

To address this question, the 21 studies were analyzed, and the characteristics are presented below. Table 2 includes an overview of the reviewed studies and their instructional practices on one or more print domains. Figure 2 provides the frequency of the instructional tiers (e.g., small group – Tier 2, individual – Tier 3, etc.) and Figure 3 includes the frequency of the print domains across the studies. Figure 4 offers a visual of the percentages for the type of instructional techniques used across the interventions.

Out of the 21 studies, one used observational methods (OBS); thirteen used experimental design with two of those using quasi-experimental design (QED) and eleven implementing randomized control trials (RCT); and seven implemented correlational (COR) designs.

Table 2. Characteristics of Effective Print Domain(s) Instructional Practices

Study	Study Design	Print Domain(s)	Instructional Setting	Instructional Techniques
Bean et al. (2019)	COR	Alphabet knowledge; Concepts of print/print awareness	Whole class (Tier 1)	Teacher-led shared book reading; book reading orientation
Bratsch-Hines et al. (2019)	COR	Alphabet knowledge	Free choice/center settings; small group; large group (Tiers 1, 2, and 3)	Teacher-child language exchanges and domain-specific learning activities
Carson et al. (2019)	RCT	Alphabet knowledge	Whole class (Tier 1)	10-weeks of phonological awareness and letter-sound knowledge instruction; stories followed by games
DeBaryshe (2023)	QED	Alphabet knowledge	Whole class; small groups (Tiers 1 and 2)	Teacher-led instruction within context of thematic units; activities such as alphabet sand writing, morning message, journaling, class books, and classroom print
Kim & Riley 2021	RCT	Concepts of print/print awareness	One-on-one (Tier 3)	Parent-instructed dialogic reading intervention
Lederberg et al. (2022)	RCT	Alphabet knowledge; alphabetic principle	Whole class (Tier 1)	Foundations for Literacy program
Neha et al. (2020)	COR	Alphabet knowledge	One-on-one (Tier 3)	Parent-child shared book reading
O'Leary & Ehri (2020)	RCT	Alphabet knowledge; alphabetic principle	One-on-one (Tier 3)	Phoneme segmentation with letters and shapes
Piasta et al. (2019)	COR	Alphabet knowledge; concepts of print/print awareness	Whole class; small groups (Tiers 1 and 2)	Teachers' knowledge and practice
Piasta et al. (2021)	QED	Alphabet knowledge	Small group (Tier 2)	Nemours BrightStart! program; 20 weeks/50 minutes per week

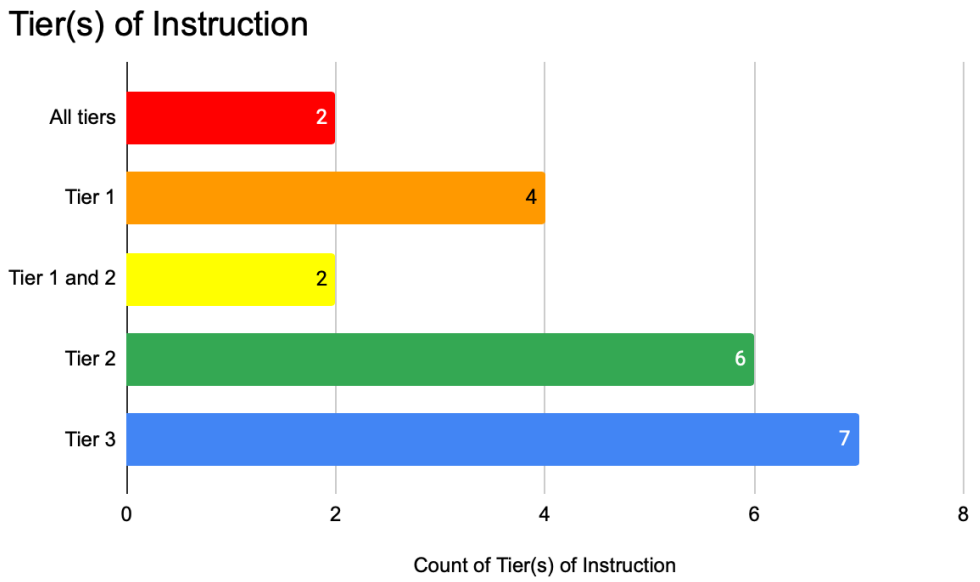
Piasta et al. (2022)	RCT	Alphabet knowledge; concepts of print/print awareness	Small group (Tier 2)	Nemours BrightStart! program; 20 weeks/50 minutes per week
Rachmani (2020)	RCT	Alphabet knowledge	Small group (Tier 2)	Game and book intervention, 10 weeks, 10-15 minutes twice weekly
Riser et al. (2020)	COR	Alphabet knowledge; concepts of print/print awareness; alphabetic principle	One-on-one (Tier 3)	Home literacy environment/shared book reading
Roberts et al. (2020)	RCT	Alphabet knowledge	Small group (Tier 2)	Contextualized or decontextualized instruction
Roberts et al. (2019)	RCT	Alphabet knowledge	Small group (Tier 2)	Paired-associate learning (PAL), PAL plus orthographic learning, or PAL plus articulatory learning
Schaughency et al. (2023)	RCT	Alphabet knowledge; alphabetic principle	One-on-one (Tier 3)	Tender Shoots; parent-child shared book reading intervention
Schmidt et al. (2024)	COR	Concepts of print/print awareness	Whole group (Tier 1)	Drama-based reading; Pantomime, directed imagination, vocal variety and facial expressions, character development
Shea et al. (2025)	COR	Alphabet knowledge; concepts of print/print awareness	Self-interested learning centers; whole class; small group (Tier 1, 2, and 3)	Literacy-focused curricula (e.g., Handwriting Without Tears; Ready, Play, and Learn!) and non-literacy-focused curricula (e.g., Creative Curriculum, Reggio Emilia Approach)
Timperley et al. (2022)	RCT	Concepts of print/print awareness	One-on-one (Tier 3)	Tender Shoots; parent-child shared book reading intervention
Treiman et al. (2018)	OBS	Alphabet knowledge; concepts of print/print awareness (explicit talk about alphabet letters, printed words, reading processes and conventions)	Home visits (analysis of talk that was recorded during daily activities at home) One-on-one (Tier 3)	Literacy-related conversations between parent and child

Zettler-Greeley et al. (2018)	RCT	Alphabet knowledge	Small group (Tier 2)	Nemours BrightStart! program; 9 weeks/50 minutes per week

QED=quasi-experimental design; RCT=randomized control trial; COR=correlational; OBS=observational

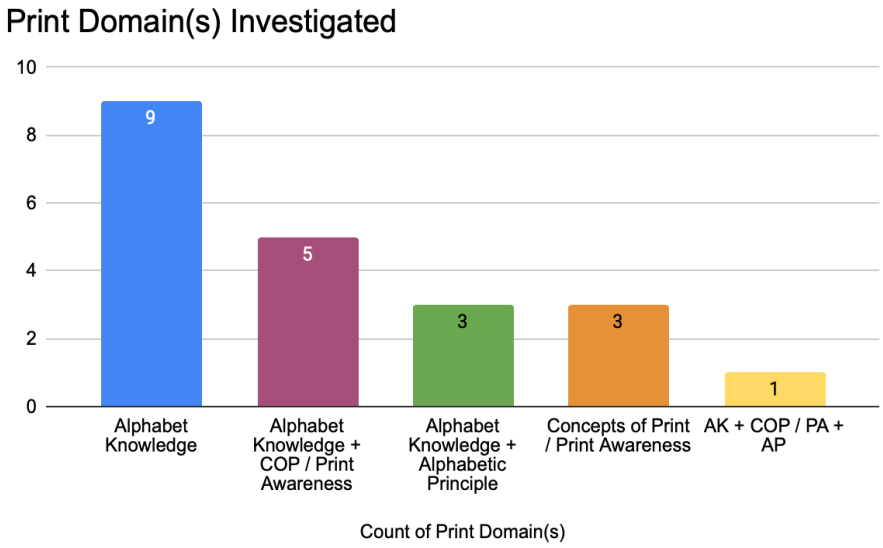
Out of the 21 studies reviewed, Tier 2 (small group) and Tier 3 (individual) instruction were implemented the most. For the studies that included Tier 1 instruction, two of the four of them focused on using book reading to teach concepts of print, which is a typical use of whole-group instruction in a preschool setting. To explicitly teach letters and sounds (i.e., alphabet knowledge) and how those sounds blend to make words (i.e., alphabetic principle), Tier 2 and Tier 3 instructional settings were commonly used. The patterns across these studies align to the findings from Shanahan and Lonigan (2010) in that small groups and one-on-one instruction is widely used and found to be effective to teach code-based skills. Figure 2 provides the number of occurrences of the instructional tiers across the 21 studies.

Figure 2. Frequency of Instructional Tier(s)



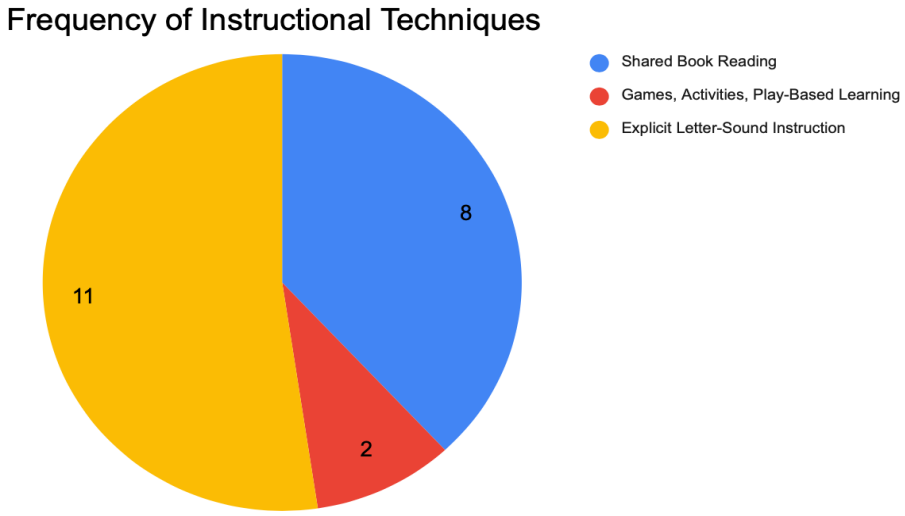
In addition to identifying the frequency of the instructional settings, the print domains were analyzed and tallied. Figure 3 offers a visual for the number of studies that investigated each of the print domains. The majority of the studies investigated effective ways to teach letters and sounds (e.g., alphabet knowledge) along with concepts about print/print awareness. These findings align with the recommendations to build print awareness through shared book reading and to develop knowledge of letters and sounds from the What Works Clearinghouse report for preparing young children for school (Burchinal et al. 2022). Fewer studies investigated evidence-based strategies to teach preschool students the alphabetic principle as that skill can often be taught closer to the end of preschool or once students enter kindergarten. The alphabetic principle involves an understanding that words are read by mapping individual phonemes to graphemes, which is a step beyond a preschool student knowing the names of letters and their corresponding sounds. Given that some preschool curricula focus more on whole-child developmental aspects (e.g., social skills, play, exposure, etc.) than on teaching explicit code-based emergent literacy skills, it is not surprising that the alphabetic principle was explored the least.

Figure 3. Frequency of Print Domains Investigated



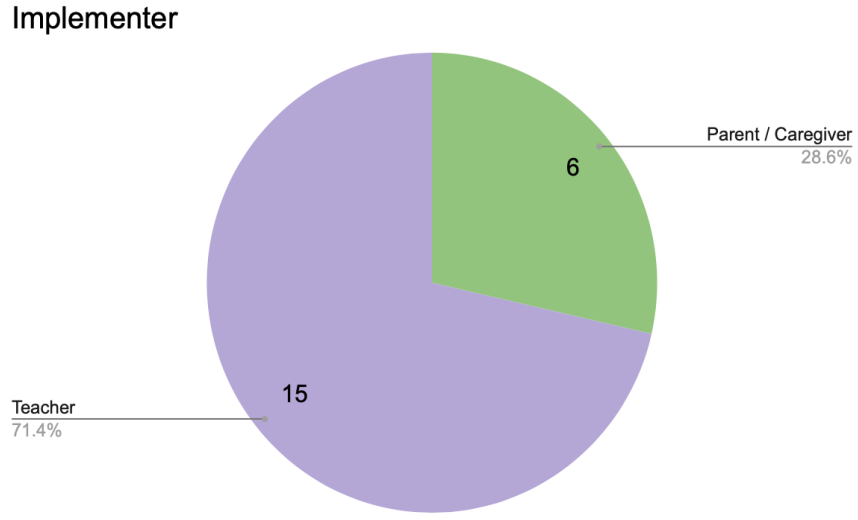
In addition to the setting and the specific print domains taught, the instructional techniques were also analyzed and coded. Most of the studies investigated how explicit instruction on letters and sounds impacted the development of alphabet knowledge or the alphabetic principle. To examine concepts of print / print awareness, many of the studies implemented a version of shared book reading. Studies were coded based on the instructional techniques that were the primary focus. For example, one study (Carson et al. 2019) implemented a 10-week phonological awareness and letter-sound instructional intervention where the instruction was followed by a game or activity. That was coded for explicit letter-sound instruction as opposed to games, activities, play. Figure 4 offers a tally of the frequency of the instructional techniques.

Figure 4. Frequency of Instructional Techniques



Finally, across the studies, most interventions were provided by teachers; however, nearly a third of them were implemented by parents or caregivers, often in the home literacy environment. Out of the six studies that involved parents or caregivers as the implementer, two of them investigated the Tender Shoots program (Schaughency et al., 2023; Timplerly et al. 2022), which is a teacher-facilitated program that coaches parents on shared book reading practices to implement at home. The other studies that included parents / caregivers as the implementer observed the shared book reading or literacy conversational practices and explored how those impacted print-based outcomes. Across the studies where teachers provided the instruction, the interventions involved shared book reading, explicit print-based instruction in small group or whole group settings, and / or the integration of games, activities, and play-based learning to teach and reinforce print knowledge.

Figure 5. Frequency of Type of Implementer



Effects and Other Findings

The second research question sought to identify the features of the instructional practices that were associated with improved outcomes across one or more print domains.

Research Question 2: What features of the instructional practices (e.g., duration, age, dosage) are associated with improved print domain outcomes? Do these features differ according to student characteristics?

The 21 studies were analyzed, and the results are presented in this section. Table 3 provides an overview of the measures, outcomes, student characteristics, and description of classroom activities.

Table 3. Associated Outcomes Based on Features of Print-Based Instruction

Study	Print Domain(s) + Measures	Outcomes	Instructional Setting + Dosage	Instructional Techniques	Student Characteristics
Bean et al. (2019)	Alphabet knowledge; concepts of print/print awareness Upper and lowercase subtest of the Phonological Awareness Literacy Screening Pre-K; preschool word and print awareness test	For TD children, significant correlations between book-reading orientation and alphabet knowledge (rs=.45 and .41; respectively) and spring print-concept knowledge (r=.35). For children with autism, significant correlations between book-reading orientation and print-concept knowledge (rs=.45).	Whole class (Tier 1) Twice per week for the school year at home; regular book reading for whole class with teacher at school for the school year	Teacher-led shared book reading; book reading orientation	103 (3 groups) preschool children; autism (n=22), developmental language disorder (DLD; n=23), and typical development (TD; n=58)
Bratsch-Hines et al. (2019)	Alphabet knowledge Letter-word identification	Letter-word ID was higher when children spent more time in small groups (g=0.13)	Free choice/center settings; small group; large group (Tier 1, 2, and 3) 5-minute snapshots; 10 30-second cycles of teacher-child language exchanges	Teacher-child language exchanges and domain-specific learning activities	455 pre-k children 36% dual language learners (DLLs)
Carson et al. (2019)	Alphabet knowledge;	Overall experimental effect for LSK, d=0.74; for children	Whole class (Tier 1)	10-weeks of phonological awareness and	90 4-year-olds; 50 experimental, 40 control (13 experimental; 10 control SLD – spoken language difficulties)

	alphabetic principle South Australian Phonological Awareness Database (SAPAD) – letter sound knowledge; non-words from the Reading Freedom Diagnostic Reading Test	with SLD for LSK, d=1.41; experimental group phoneme-grapheme conversions in non-words, d=0.55	Two 40-minutes sessions weekly	letter-sound knowledge whole-group instruction; stories followed by games and activities in whole group	
DeBaryshe (2023)	Alphabet knowledge Test of Early Reading Abilities (TERA); knowledge of uppercase letters; alphabet knowledge	Intervention and control groups were the same; TERA had effect on time (pes=0.07) and intervention group (pes=0.07); UC Letters had time effect (pes=0.02) and intervention group (pes=0.05); alphabet knowledge (d=1.57)	Whole class; small groups (Tiers 1 and 2) Year-long curriculum with 140 activities; daily large-group lesson, 2-3 daily small group lessons	Teacher-led instruction within context of thematic units; activities such as alphabet sand writing, morning message, journaling, class books, and classroom print	230 pre-k children from Head Start classrooms 13% DLL; 6.1% SWD
Kim & Riley 2021	Concepts of print/print awareness Story and Print Concepts Test, from the Head	Homework assignment condition: B=2.03 (for print awareness fixed effect)	One-on-one (Tier 3)	Parent-instructed dialogic reading intervention	87 2-to-3-year-old children and their parents/ caregivers

	Start Family and Child Experiences Survey				
Lederberg et al. (2022)	Alphabet knowledge; Alphabetic principle Letter-sound correspondences	DHH children in the intervention group showed greater statistically significant gains on tests of alphabetic knowledge and word reading than children in the control group. Effect sizes were moderate to large.	Whole class (Tier 1) One hour each day for a school year	Foundations for Literacy program	The FFL intervention group included 118 DHH children and the control group included 110 DHH children. 3- to 6-year-olds
Neha et al. (2020)	Alphabet knowledge Letter Naming Fluency task of the DIBELS Pre-K	Children's early academic skills correlated positively with maternal elaboration during the shared event and birth stories, with maternal linking during birth stories, with maternal repetitions during shared event stories, and negatively with maternal descriptions/labels during book reading.	One-on-one (Tier 3)	Parent-child shared book reading/home learning environment (HLE)	41 whanau (New Zealand Maori families and community) their young children (M=4 years, 4 months)

O'Leary & Ehri (2020)	Alphabet knowledge; alphabetic principle Invented spelling; proper name recall (orthographic facilitation)	Cohen's d effect sizes favoring spellings over numbers as print labels were moderate: 0.49 for PS letter condition, 0.43 for PS shape condition, and 0.59 for rhyming control condition.	One-on-one (Tier 3)	Phoneme segmentation with letters and shapes	60 4-year-olds in preschool and kindergartens
Piasta et al. (2019)	Alphabet knowledge; concepts of print/print awareness Content knowledge measure; knowledge for practice measure; one full-day videotaped classroom observation in fall and spring (instruction coded with Teacher Behavior Rating Scale: book reading, print and letter knowledge); Preschool Word and Print	Content knowledge r=.24 and knowledge for practice r=.21 were significantly correlated with classroom practice	Whole class; small groups (Tiers 1 and 2)	Teachers' knowledge and practice	485 early childhood teachers and 2,004 preschool students

	Awareness assessment; Uppercase and Lowercase Letter Recognition subtests of the Phonological Awareness Literacy Screening for Preschool				
Piasta et al. (2021)	Alphabet knowledge	Dosage for community aide implementation was 7 more lessons than teachers, d=-1.17	Small group (Tier 2) Teacher implemented (17); community-aide implemented 19	Nemours BrightStart! program; 20 weeks/50 minutes per week	36 preschool classrooms with at least one child who was identified as at risk
Piasta et al. (2022)	Alphabet knowledge; concepts of print/print awareness Get Ready to Read!–Revised (GRTR-R) print knowledge; Print Knowledge subtest of the Test of Preschool Early Literacy; Letter Sound Short Forms; and Quick Letter	# of lessons received was positively associated with children's posttest scores on the GRTR-R (b=.08) print knowledge (b=.22) letter– name knowledge (b=.37) and letter writing (b=.01) but not any of the other outcomes	Small group (Tier 2) Random assignment to teacher-implemented, community-aide implemented and BAU	Nemours BrightStart! program; 20 weeks/50 minutes per week; each lesson has a 7-part instructional routine with interactive manipulatives to support learning (e.g., magic erase boards, boxes and gel bags for letter writing; mirrors for viewing mouth and tongue movements;	281 at-risk preschool students; 2% had IEP / 504

	Name Knowledge Assessment			magnifying glasses for letter identification; picture cards, etc.); used GRR / explicit modeling and practice	
Rachmani (2020)	Alphabet knowledge PALS-PreK: name writing; AK (split into upper-case (UC) and lower-case (LC) letters and letter-sounds (LSs)); print and word awareness. Name writing and letter naming assess children's AK.	LS d=1.38 (large) UC letters d=.52 (medium) No significant difference for LC letters and name writing	Small group (Tier 2)	Game and book intervention, 10 weeks, 10-15 minutes twice weekly	42 4-year-olds, 18 control; 24 intervention
Riser et al. (2020)	Alphabet knowledge; concepts of print/print awareness; alphabetic principle Comprehensive Test of Phonological and	Home literacy context positively associated with reading skills r=.21; shared book reading B=2.12	One-on-one (Tier 3)	Home literacy environment/ shared book reading	605 American Indian and Alaska Native (AIAN) preschool children

	Print Processing; ECLS-B preschool-aged reading test (letter sound knowledge and letter recognition, print conventions, and word recognition)				
Roberts et al. (2020)	Alphabet knowledge All measures were administered individually, in a randomized order Four families of variables: alphabet knowledge in isolation accuracy, alphabet knowledge in isolation fluency, alphabet knowledge in word contexts accuracy, and distal outcomes	Experimental condition and DLL status showed that children in the decontextualized condition small groups had statistically significantly greater gains than children in the contextualized condition small groups on taught letter sounds (alphabet knowledge in isolation accuracy) ES=0.53 Post hoc analysis: Letter name and letter sound gains were	Small group (Tier 2) Children were randomly assigned within classrooms to small groups randomly assigned to one of the two treatments; research assistants provided 10 weeks of instruction, 12–15 minutes per day, four days per week	Contextualized or decontextualized instruction	127 preschool children (48 dual-language learners) in 5 public schools with low-income eligibility thresholds

		statistically significantly higher for the taught letters than for the untaught letters. Letter names ES= 2.22; letter sounds ES=2.87			
Roberts et al. (2019)	Alphabet knowledge letter name and letter sound ID accuracy and rapid ID of letter names and letter sounds	PAL-only condition was consistently advantageous for non-DLL children compared with both PAL+AL and PAL+OL conditions on four measures: letter name and letter sound ID accuracy and rapid ID of letter names and letter sounds The associated effect sizes were moderate and ranged from 0.51 to 0.67 The largest effect size (0.67) in favor of the PAL-only	Small group (Tier 2) Children were randomly assigned within each classroom to small groups that were randomly assigned to one of the three treatments and to one of two orders in which letter names and letter sounds were taught	Paired-associate learning (PAL), PAL plus orthographic learning (OL), or PAL plus articulatory learning (AL) Research assistants provided 10 weeks of instruction for 12–15 minutes per day, four days a week.	94 children (including 35 dual-language learners, in 8 public preschool classrooms with low-income eligibility thresholds): 32 children (nine small groups; 13 DLLs) in PAL; 32 children (nine small groups; 13 DLLs) in PAL+AL; and 30 children (nine small groups; nine DLLs) in PAL+OL

		condition was on letter sound identification; for DLL children, there were no statistically significant differences between conditions			
Schaughency et al. (2023)	Alphabet knowledge; alphabetic principle	Benefits of SSS participation for children's letter sounds (d=.74), pseudoword (d=.85) and word reading (d=.66), book level (d=.82), and teacher judged reading (d=.60) relative to ABC, with medium to large effects	One-on-one (Tier 3)	Tender Shoots; parent-child shared book reading intervention 1 year after implementation	69 3-4.5 year-old children and their parents
Schmidt et al. (2024)	Concepts of print/print awareness Story recall measures: free recall and cued recall	Drama-based strategies were significantly and positively correlated with student story retell: frequency of directed pantomime (r[62]=.29) directed imagination (r[62]=.25) teacher pantomime (r[62]=.26) were associated	Whole group (Tier 1) Teachers Use of Story Time Strategies for Drama (TUSSD); 3 read-alouds, Fall, Winter, Spring	Drama-based reading; pantomime, directed imagination, vocal variety and facial expressions, character development	196 pre-k children; 28% bilingual; 10% SWD

		with cued recall during Time 2 Quality of directed pantomime was also positively correlated with cued recall at Time 2, r(62)=.31) Frequency of directed pantomime (r[45]=.43) directed imagination (r[45]=.39) were related to students freely recalling story components during Time 3; teachers' quality of directed imagination was also positively associated with free recall (r(45)=.31) Quality of character development positively correlated with student free recall of the story, (r(45)=.31) Teacher's frequency of facial expressions			

		was positively correlated with student responses to cued recall, r(45)=.34)			
Shea et al. (2025)	Alphabet knowledge; concepts of print/print awareness TOPEL Print Knowledge; Quick Letter Name Knowledge Assessment; Letter Sound Short Forms	Teacher-reported use of literacy-focused curricula in classrooms - no significant associations for print and letter knowledge (β=0.22). Risk status of participant was significantly associated with gains for print and letter knowledge β=0.12) when literacy-focused curricula was implemented	Self-interested learning centers; whole class; small group (Tiers 1, 2, and 3)	Literacy-focused curricula (e.g., Handwriting Without Tears; Ready, Play, and Learn!) and non-literacy-focused curricula (e.g., Creative Curriculum, Reggio Emilia approach)	571 pre-k children; 2% SWD; 281 identified as at risk for later reading difficulties
Timperley et al. (2022)	Concepts of print/print awareness	Parents in the SSS group used statistically more print talk at 1-year follow-up than parents in ABC (d=.959) and RRR (d=.834) Children	One-on-one (Tier 3)	Tender Shoots; parent-child shared book reading intervention; 6 weeks	69 3-4.5 year-old children and their parents 24 - Rich Reading and Reminiscing (RRR); 23 - Strengthening Sound Sensitivity (SSS); 22 - Activity-Based Control (ABC)

		in the SSS group used statistically more print talk at 1-year follow-up than those in ABC (d=.854) or those in RRR (d=.891)			
Treiman et al. (2018)	Alphabet knowledge; concepts of print/print awareness (Explicit talk about alphabet letters, printed words, reading processes and conventions)	Explicit talk about the elements and processes of reading and writing occurred even when children were less than two years old and became more common as children grew older The majority of literacy-related conversations included talk about alphabet letters Literacy-related conversations occurred in a variety of contexts, not only book-reading	Home visits (analysis of talk that was recorded during daily activities at home) One-on-one (Tier 3)	Literacy-related conversations between parent and child 12 home visits before children entered kindergarten	56 families
Zettler-Greeley et al. (2018)	Alphabet knowledge	The fall-to-winter treatment effect size for gains in print knowledge was	Small group (Tier 2) Explicit,	Nemours BrightStart! program; 9 weeks/50 minutes per week	476 pre-k children at risk of reading failure

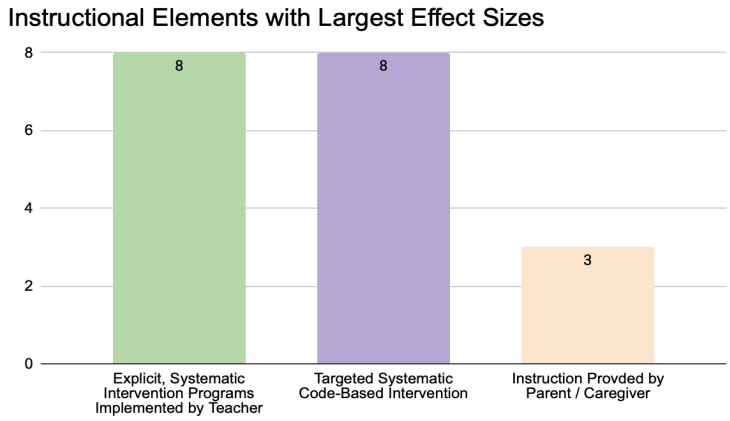
	Test of Preschool Early Literacy; 36-item Print Knowledge subtest - knowledge of alphabet and print concepts, including letter name and letter sound knowledge	moderate to strong (g=.74)	multisensory, emergent literacy instruction in small groups provided by early literacy interventionists	18-lesson intervention; two 30- to 40-minute pull-out lessons weekly; small groups of 4 or fewer children	

Out of the 21 studies included in the second research question, five them included students with a disability (SWD), four of them included students identified as at risk of later reading difficulties, five included English learners (EL) or dual language learners (DLL), and nine of them included general education populations. Some of the studies included multiple categories of students (e.g., both SWD and DLL).

Alphabet Knowledge Outcomes

Fifteen studies had outcomes for alphabet knowledge: two found large effect sizes, ten had medium effects, and three had small effect sizes. The studies with the largest effect sizes included interventions that were provided by a teacher/researcher/interventionist, involved targeted and systematic code-based instruction, and/or implemented by a parent or caregiver in a one-on-one setting. Some studies included both systematic code-based instruction and the implementation of the intervention by a teacher; thus, those were coded as both in the figure below.

Figure 6. Instructional Elements with Largest Effect Sizes



All of the studies with medium to large effect sizes for alphabet knowledge that were implemented by a teacher were in small group or large group settings. For example, DeBaryshe (2023) studied the implementation of a year-long curriculum, Learning Connections, that supplemented the Creative Curriculum in Head Start classrooms in Hawaii. Their sample included 230 pre-k children, with 13% of the sample identified as dual language learners (DLL) and 6.1% identified as having a disability. Learning Connections is a research-based, skill-focused curriculum that addressed oral language, phonological awareness, alphabet knowledge, concepts of print, and emergent writing. It includes 140 activities for one daily large group activity and 2-3 daily small group activities. Some of the activities include writing letters in sand, journaling with the support of teacher scaffolds, and transferring items and objects to build finger control skills. They measured knowledge of upper-case letters and alphabet knowledge. For upper case letter knowledge, they found a small effect size for the intervention group (partial eta squared=0.05). However, they found a large effect size for alphabet knowledge (d=1.57).

Other studies that examined a systematic and explicit intervention implemented by a teacher found strong effects for alphabet knowledge (Lederberg et al., 2022; Carson et al., 2019; Rachmani, 2020; Roberts et al., 2020; Roberts et al., 2019; Zettler-Greeley et al., 2018; Bean et al., 2019). Lederberg, Easterbrooks, and Tucci (2022) found the Foundations for Literacy (FFL) program had medium to large effects for preschool children who were deaf or hard of hearing (DHH). Compared to the control group, the children who were DHH in the intervention group had significant gains on alphabet knowledge based on letter-sound correspondence measures. The FFL program was implemented in a whole class setting for one hour each day over the course of a school year. In their whole-class, 10-week intervention with 90 four-year-old students, Carson, Bayetto, and Roberts (2019) found large effects for alphabet knowledge when teachers explicitly taught phonological awareness and letter-sound knowledge followed by games and stories in 40-minute lessons twice per week. For letter sound knowledge (LSK) the experimental effect was d=0.74 and for students with spoken language difficulties the LSK effect was d=1.41.

Also using a 10-week intervention, but in a small group setting for 10-15 minutes twice per week, Rachmani (2020) found that among 42 four-year-old children (18 control; 24 intervention) the effects on letter sound knowledge (d=1.38) and uppercase letters (d=0.52) were significant. Roberts, Vadasy, and Sanders (2020) investigated alphabet knowledge outcomes based on contextualized or decontextualized instruction in small group sessions that took place four days each week for 12-15 minutes over 10 weeks. The 127 preschool students were randomly assigned to one of the two groups with 48 of the participants identified as dual language learners (DLL). They found that when instruction was decontextualized the students made significant gains in taught letter sounds (ES=0.53). In a post-hoc analysis, they found that taught letters had greater outcomes than untaught letters: for letter names (ES=2.22) and for letter sounds (ES=2.87). Another small group study performed by Roberts, Vadasy, and Sanders (2019) randomly assigned 94 preschool children (35 of which were dual language learners) into three groups: paired-associate learning (PAL), PAL plus orthographic learning, and PAL plus articulatory learning. Paired-associate learning involves using one concept to associate with another in order to learn. For example, in this study, PAL focused on associating letter names and sounds with written letters (graphemes) to store in long-term memory. In the PAL plus articulatory learning group, children were instructed with mouth gestures using modeling, mirrors, and mouth placement for students to increase their alphabet knowledge. In the PAL plus orthographic learning, children were provided with instructional opportunities for practice with writing and forming letters to strengthen the pathways between the letter forms and the motor skills involved in creating those forms. While they found no significant outcomes for DLL students, the PAL-only group had consistent effects across the measures compared to the PAL+AL and the PAL+OL groups. Their four measures included letter name accuracy, letter sound accuracy, rapid letter naming, and rapid letter sound naming. The effect sizes ranged from d=0.51 to d=0.67 with the largest effect being letter sound identification for accuracy (d=0.67).

Zettler-Greeley, Bailet, Murphy, DeLucca, and Branum-Martin (2018) explored the effects of the Nemours BrightStart! program with 476 preschool children at risk of later reading difficulties and found a moderate treatment effect for print knowledge (g=0.74). In their study of small group

instruction over 9 weeks, students were taught 18 explicit and multisensory literacy lessons at two 30-40-minute interventions each week. Finally, Bean, Perez, Dynia, Kaderavek, and Justice (2019) examined teacher-led shared book reading in a whole-class setting twice each week for a school year with 103 preschool children; 22 identified as having autism, 23 identified with a developmental language disorder, and 58 typically developing children. They found correlations for typically developing children between book reading orientation and alphabet knowledge (r=0.45).

One study that did not include an explicit intervention, yet had moderate effects was Piasta et al. (2019) that examined the correlation between teachers' content knowledge and knowledge for practice and preschool student outcomes on alphabet knowledge. Content knowledge (r=0.24) and knowledge for practice (r=0.21) significantly correlated to classroom practice, and knowledge for practice significantly correlated to print concepts and letter naming.

Further, three studies found moderate effects when instruction was provided by a parent or a caregiver. Two of the three studies explored home literacy practices (Neha et al. 2020; Riser et al. 2020) and one investigated the effects of the parent-child shared book reading intervention Tender Shoots program (Schaughency et al. 2023). Neha, Reese, Schaughency, and Taumoepeau (2020) observed and analyzed the shared book reading practices and the home learning environments of 41 New Zealand Maori families with their four-year-old children. They found a correlation between the family literacy practices and early academic literacy skills which were assessed in part using the DIBELS Letter Naming Fluency (LNF) task for PreK. Similarly, Riser, Rouse, Choi, and Ku (2020) explored the home literacy environment and shared book reading practices among 605 American Indian and Alaskan Native preschool children. They found the home literacy practices positively correlated to reading skills (r=0.21). In their study on the effects of the Tender Shoots program, Schaughency, Linney, Carroll, Das, Riordan, and Reese (2023) discovered that children who participated in the group that focused on sound sensitivity had significant outcomes for alphabet knowledge (letter sounds: d=0.74).

Three studies had small effect sizes for alphabet knowledge outcomes. Shea, Piasta, Shen, Hudson, Greeley, Lewis, and Logan (2025) explored the degree to which preschool teachers used literacy-focused curricula and if using that curricula was associated with preschool children's gains in emergent literacy. Teachers self-reported the curriculum they implemented with 15 classrooms using a literacy-focused curricula such as Handwriting Without Tears (HWT), Letter People, Nemours Bright Start!, or The Emerging Language and Literacy Curriculum (ELLC), and 83 classrooms reported using non-literacy-focused curriculum such as Creative Curriculum, High Scope, Scholastic or Reggio Emilia Approach. The literacy-focused curricula also infused play-based learning, with many of them using a multisensory approach, structured purposeful play, hands-on learning, movement, music, and centers. They used emergent literacy measures in 571 pre-k children, 2% of the sample were students with disabilities and 281 children were identified as at risk for later reading difficulties. They found no significant effect for associations between literacy-focused curriculum and letter and print knowledge. However, they found a small association effect when the child risk status was included (β=0.12). Bratsch-Hines, Burchinal, Peisner-Feinberg, and Franco (2019) examined teacher-child language exchanges during large group, small group, and free choice / center

settings with a student sample of 455 pre-k children in rural North Carolina. From their observations, children were in free choice/centers the majority of the time (49%) with large group (35%) and small group (8%) time occurring less frequently. They found that 18% of the time children engaged in print-related activities, 9% of the time were spent in oral language / vocabulary activities, 5% of the time was allocated to sound-based learning, and 5% spent on writing activities. They used the Letter Word Identification measure and found a small effect size (g=0.13) for children when more time was spent in small groups. Similar to Zettler-Greeley et al. (2018), Piasta et al. (2022) studied the effects of the Nemours BrightStart! program, randomly assigned students to be instructed by a teacher or by a community aide. For the 281 students who were identified as at risk for later reading difficulties (2% of the sample had an IEP or 504 plan), they were randomly assigned to a different implementer, yet they all received 20 weeks of the intervention for 50 minutes each week. The BrightStart! program is structured with a seven-part routine that used the gradual release of responsibility model. The program uses mirrors to model and practice mouth placement and articulation, picture cards, white boards to practice letter work, and other manipulatives to make the learning interactive. They found that the number of lessons (i.e., dosage) was correlated to effects on alphabet knowledge (letter-name knowledge: b=0.37; letter writing: b=0.01).

Across these findings, explicit code-based instruction yielded moderate to large outcomes for preschool students. The specific intervention programs were relatively short in frequency and duration (e.g., two or three times weekly, average of 20–30-minute lessons, etc.) meaning that instruction does not have to be lengthy lessons, but that short, consistent, and targeted lessons can support the development of alphabet knowledge in preschool children. Further, the interventions do not have to be implemented by a teacher to be effective. Parents, caregivers, and community aides provided instruction and had significant outcomes on print domains.

Concepts of Print/Print Awareness Outcomes

Five studies had positive effect sizes for concepts of print / print awareness. Two of the five studies involved book reading instruction provided by parents or caregivers (Timperley et al. 2022; Kim & Riley, 2021), and two studies included interventions implemented by teachers (Bean et al. 2019; Piasta et al. 2022). One study (Piasta et al. 2019) did not study a specific intervention but explored the associations between teachers' content knowledge and knowledge for practice and student outcomes on print concepts. They found teachers' knowledge for practice was correlated with student scores for print concepts through associations between classroom language and literacy practices (B=0.25).

Using the Tender Shoots program that provided parents and caregivers with tools to implement a six-week shared book reading intervention at home, Timperley and colleagues (2022) found large effect sizes for print knowledge: the amount of print talk for parents was greater for the group that focused on sound sensitivity in their shared book reading practices (d=0.959 compared to the control group; d=0.834 compared to the group who focused on text meaning). Similarly, the amount of print talk for children was greater in the sound sensitivity group than in the control (d=0.854) and text meaning groups (d=0.891). Kim and Riley (2021) examined the

outcomes on a parent-child dialogic reading intervention with 87 two- and three-year-old children and found a fixed effect on print awareness (B=2.03).

In their study on the Nemours BrightStart! program that examined the effect of the dosage and implementer, Piasta and colleagues (2022) found a positive correlation between the number of lessons and print knowledge (b=0.22). In addition to finding correlations between book reading orientation and alphabet knowledge, Bean and colleagues (2019) found significant correlations between book reading orientation and print-concept knowledge for typically developing children (r=0.35) and for students with autism (r=0.45).

Alphabetic Principle Outcomes

Three of the 21 studies measured outcomes related to the alphabetic principle (Carson et al. 2019; Schaughency et al. 2023; O'Leary & Ehri, 2020). As mentioned in a prior section, the alphabetic principle in preschool is less likely to be an area of focus as it is a skill and understanding that is a key target for instruction starting in kindergarten. However, the earlier that children can begin to understand that words are made up of individual phonemes, combinations of the letter sounds they have learned, the easier it will be for them to learn to decode and to build their word recognition skills. Carson, Bayetto, and Roberts (2019) examined the effects of a 10-week phonological awareness and letter-sound knowledge intervention on 90 four-year-olds and found a medium effect size for the alphabetic principle. The intervention was implemented by preschool teachers who were coached by speech language pathologists, and it included two 40-minute sessions each week and involved a whole-class explicit lesson followed by games and activities for additional practice. Fifty students were in the experimental group, of which thirteen had spoken language difficulties; forty were in the control group, of which ten had spoken language difficulties (SLD). They found that children in the experimental group had greater phoneme-grapheme conversions in non-words than those in the control group (d=0.55). Students with SLD in the experimental group scored higher on their phoneme-grapheme conversations compared to students with SLD in the control group, however, there were no significant differences between the groups (d=0.04). The intervention implemented explicit and systematic code-based instruction on a daily basis consisting of short and targeted lessons.

In a study that investigated the effects of a parent-child shared book reading program (i.e., Tender Shoots) over the course of a school year, Schaughency, Linney, Carroll, Das, Riordan, and Reese (2023) found medium effect sizes for alphabetic principle outcomes. Sixty-nine three- and four-year-old children and their parents were randomly assigned to a group that focused on strengthening sound sensitivity (SSS), rich reading and reminiscing (RRR), or non-reading activities. They found that the students in the SSS group had stronger outcomes than the ABC group on reading pseudowords (d=0.85) and word reading (d=0.66). Although they found that the literacy skills for the RRR and SSS groups were relatively the same, when they followed up to measure the beginning reading skills, they identified that the focus on sounds had an impact. They write, "…children's beginning reading benefitted only when the earlier shared reading was regularly accompanied by intentional learning experiences with PA, but not by shared reading alone" (p. 462).

O'Leary and Ehri (2020) implemented one-on-one instruction for 60 four-year-old students to explore whether orthographic facilitation could play a role in preschool students' ability to pronounce unfamiliar words if mediated by spelling. They note that orthographic facilitation "occurs when exposure to spellings improved readers' memory for the pronunciations of novel words tested without spellings present" (p. 76). The students in the study were assigned to one of three groups: a phoneme segmentation group that used letters to represent phonemes; a phoneme segmentation group that used irrelevant shapes to represent phonemes; and a control group. They found that the students in the PS group with letters were able to connect graphemes to phonemes and map the spellings of the words in the proper name-learning task. When students were assessed on recalling print labels when presented in spellings or irrelevant numbers, students were able to recall spellings more than the numbers (PS group with letters: d=0.49; PS group with shapes: d=0.43; control group: d=0.59). Their results demonstrate that when preschool students are shown how words are orthographically mapped (i.e., "letters mapping sounds in words" (O'Leary & Ehri, 2020, p. 88), they are more likely to learn the pronunciations of spoken words. Thus, teachers can promote alphabet knowledge and the understanding of the alphabetic principle by integrating print, modeling how phonemes match to graphemes, and writing words for children to observe.

The explicit instruction of targeted letter-sound knowledge that builds to the opportunities to practice decoding is a trend across these two studies, and their outcomes demonstrate that preschool children can start to develop their foundational skills for word recognition. Word recognition and language comprehension are the two categories of Scarborough's Reading Rope (Scarborough, 2001) that form together for reading comprehension. Ensuring that preschool children are provided with opportunities to learn and practice their language and listening comprehension skills through shared book reading and their code-based skills through explicit instruction can help them develop the key skills they need to build conventional literacy skills when they start kindergarten. The next section includes patterns of outcomes for students with a disability, students at risk for later reading difficulties, and English learners/dual language learners.

English Learners/Dual Language Learners

Five studies in this review included populations of students learning English or dual language learners. Three of the studies had medium effects for alphabet knowledge (DeBaryshe, 2023; Roberts et al. 2019; Roberts et al. 2020), one had a small effect size for alphabet knowledge (Bratsch-Hines et al. 2019), and one did not have an outcome for a print domain but was included because the instruction included concepts of print/print awareness and had outcomes for recall (Schmidt et al. 2024). Four of the five studies included small group instruction, all five were implemented by a teacher or researcher, and all of them included targeted and systematic instruction on a print domain.

Students with a Disability

A surprising finding across the five studies that examined interventions with populations of students with a disability is that all of them were implemented in whole group/Tier 1 settings. The effect sizes were medium to large for print domain areas, including alphabet knowledge (Lederberg et al. 2022; Carson et al. 2019; Bean et al. 2019; DeBaryshe, 2023); alphabetic principle (Carson et al. 2019); and concepts of print / print awareness (Bean et al. 2019). One study that did not have a specific outcome measure for a print domain (Schmidt et al. 2024) was included because they focused on concepts of print intentionally in the instruction and had positive correlations for recall measures.

Besides Tier 1 settings, the common patterns across the instructional strategies included consistency, teacher-led, and explicit and systematic instruction around print domains. For consistency, the instruction occurred weekly for at least ten weeks with some of them spanning the course of a school year. Teachers were the implementers providing whole-class instruction related to print skills and using shared reading practices with books. The instruction was explicit and systematic in that the intervention had a structure with clear routines, and the content was modeled and built on itself (e.g., target letter taught, prior target letters reviewed and practiced).

Students at Risk of Later Reading Difficulties

Four studies explored the effects of explicit, systematic literacy instruction on print knowledge for preschool students identified as at risk for later reading difficulties. Three of them examined the Nemours BrightStart! program which is an explicit, systematic and multisensory intervention focused on teaching letter and sound knowledge in small groups (Piasta et al. 2022; Piasta et al. 2021; Zettler-Greeley et al. 2018). Piasta and colleagues (2021) investigated the implementation of the BrightStart! program and if teachers and community aides differed in their delivery based on quality, adherence, dosage, and student engagement. Other than finding a significant difference in the dosage for community aides (d=-1.17) in that they delivered more lessons than teachers, the implementation across the two provider groups were not found to be significantly different. However, teachers were found to adhere to the lesson elements of the program more than the community aids (81%, 73% respectively). The Nemours BrightStart! program was found to have small to moderate outcomes for alphabet knowledge and print knowledge / concepts about print for students identified as at risk.

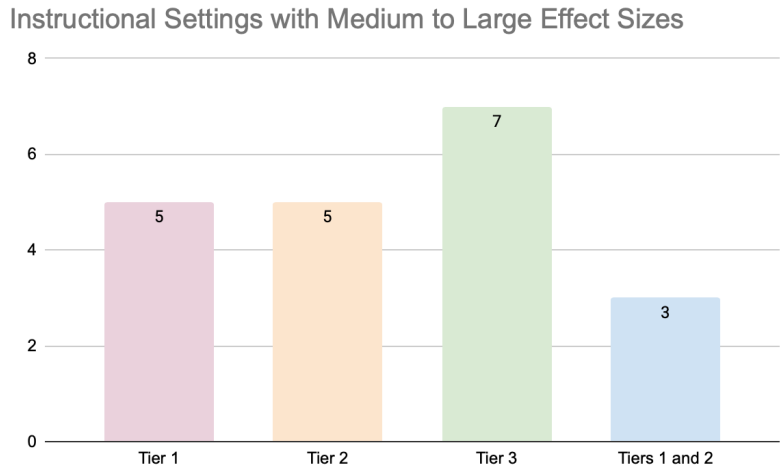
Shea, Piasta, Shen, Hudson, Greeley, Lewis, and Logan (2025) compared outcomes for students when they were instructed in preschool with a literacy-focused curriculum or a non-literacy-focused curriculum. For children at risk, they found significant associations for print and letter knowledge when children were instructed with a literacy-focused curriculum (B=0.12).

The theme across these findings indicates that children who are screened early and are identified as being at risk for later reading difficulties can develop their print knowledge when explicit, systematic literacy instruction is provided. Specifically, small group instruction can play a critical role in at-risk preschoolers learning their letters and sounds and concepts about print.

Effects of Dosage, Implementer, and Group Setting

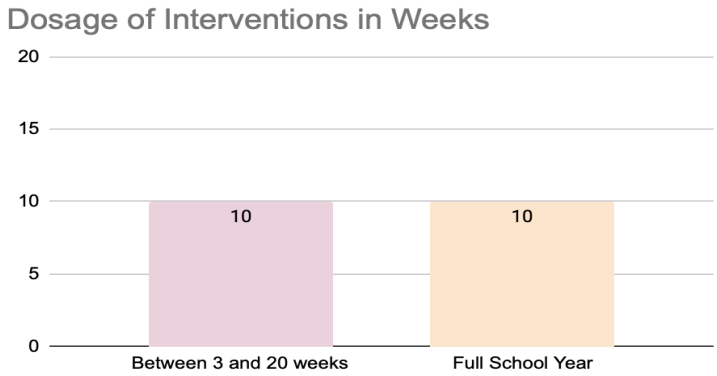
For the studies that found medium to large effects, most of them were implemented by a parent or caregiver in a Tier 3 setting. However, a blend of small groups and whole-group instruction was used across the studies with the moderate to large outcomes for print domains. The high frequency of whole-class instruction with significant outcomes is an interesting finding. Figure 7 presents the number of setting types that had medium to large effect sizes for print domains.

Figure 7. Instructional Settings with Medium to Large Effect Sizes



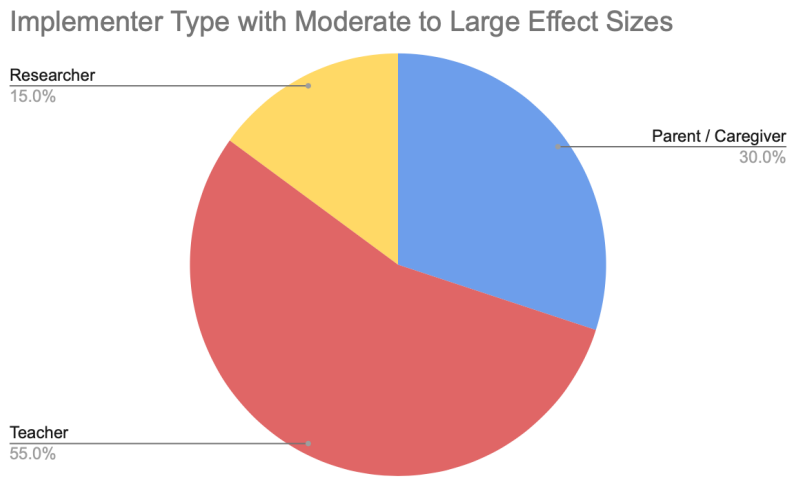
In addition to the effects of the instructional settings, the length of the intervention in weeks that had moderate to large effect sizes was split between a full school year (50% of the studies) and between 3 and 20 weeks (50% of the studies). Most of the interventions that were not the full length of the school year lasted around 10-15 weeks with a few studies ranging between 3 and 6 weeks and some lasting up to 20 weeks. The commonality across these studies, though, is the weekly consistency, the intervention occurred on a weekly basis for the duration of the intervention. Figure 8 offers a visual for the intervention length in weeks.

Figure 8. Dosage of Interventions in Weeks



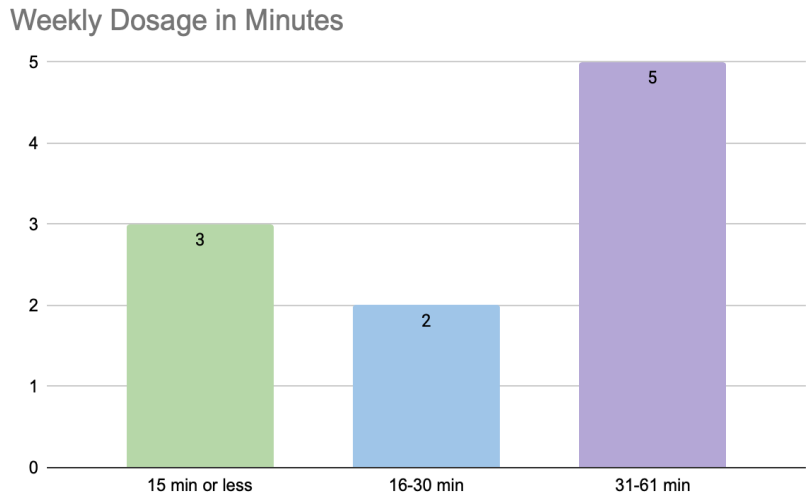
Across the studies that had moderate to large effect sizes, 55% of them had interventions provided by teachers, 30% implemented by parents / caregivers, and 15% instructed by researchers. These findings demonstrate that print domains can effectively be taught by a variety of providers.

Figure 9. Implementer Type with Moderate to Large Effect Sizes



For the interventions with moderate to large effects on print domains, most of the lessons were 30 minutes or longer in duration. However, shorter lessons that were 30 minutes or less were also found to be effective.

Figure 10. Weekly Dosage in Minutes with Moderate to Large Effect Sizes



Discussion

Integrating code-based instruction in preschool-age groups can have profound impacts on students' later literacy success. The three print domains included in the 21 reviewed studies align with The Simple View of Reading (Gough & Tunmer, 1986) and Scarborough's Reading Rope (Scarborough, 2001). In both of these reading models, the outcome is reading comprehension, which is not an expected benchmark for three-, four-, and five-year-olds; however, the components and skills that result in reading comprehension include word recognition and language comprehension. The emergent literacy skills of phonological awareness, alphabet knowledge, and emergent writing contribute to the word recognition domain (Scarborough, 2001; Moats & Tolman, 2019). Further, the emergent literacy skills of oral language, vocabulary development, concepts of print, and listening comprehension fall within the language comprehension strand (Scarborough, 2001; Moats & Tolman, 2019). Across the 21 studies reviewed, alphabet knowledge was a key area examined in the interventions which Scarborough (2001) suggests can help to build a solid foundation of word recognition.

One surprising finding across the studies was the effectiveness of Tier 1 or whole group settings for preschool children, which contrasts with Shanahan and Lonigan's (2010) note about the 2008 NELP report where no code-focused instruction used Tier 1 settings. Across the reviewed studies, one key finding was the frequency of explicit and systematic instruction around letter knowledge (including letter names and letter sounds) with many opportunities to practice through play and games. Several studies used shared book reading, often implemented by a parent or caregiver yet sometimes by teachers, to teach print concepts and to help contextualize the instruction (e.g., to show how print works in books). These findings support the recommendations from WWC; Burchinal and colleagues (2022) suggested alphabet and print knowledge should be taught explicitly and with clear modeling, with many opportunities for children to practice those skills, and to integrate real-life experiences to help children make sense of how print works. Recent research on emergent literacy points to the effectiveness of implementing explicit and systematic instruction; and that while children learning to speak is a natural process, learning to read, understanding how print and sounds work, and building knowledge of print concepts requires instruction by a knowledgeable other (Moats & Tolman, 2019).

Implications for Practice

The findings from this systematic review address the barriers discussed in the introduction: a) a common philosophy that preschool students are not ready for explicit literacy instruction and incidental learning through play should be the focus; b) a lack of training or professional development for teachers or parents/caregivers; and c) preschool curricula do not focus on literacy outcomes (e.g., Creative Curriculum).

When explicit and targeted instruction focused on print knowledge and concepts, preschool children are able to effectively learn letter names, letter sounds, how print works, and to understand the alphabetic principle. Even with policy shifts toward high academic expectations for preschool children, the pendulum does not have to swing the other direction to only include

explicit and direct instruction void of play, games, and activities that can reinforce the provided instruction in preschool classrooms. Findings from many studies support the integration of explicit print instruction alongside games and activities that allow children to practice and play with those learned skills and concepts. For example, preschool children can be explicitly taught a target letter in whole group and then work with a teacher in a small group to play games or engage in activities that focus on that letter (e.g., letter name-sound cards, sand writing, etc.).

One key theme that emerged from this review was the support provided to the implementer through coaching or training. Parents and caregivers were given training and support to implement the Tender Shoots program and teachers were provided coaching to implement some of the intervention programs. For example, Piasta and colleagues (2022) examined the outcomes on print knowledge when teachers and community aides implemented the Nemours BrightStart! program. They provided teachers with training and professional development prior to starting the intervention. This included a two-day in person training and instructed the providers on the program design, the step-by-step components, and hands-on practice. Further, Carson et al. (2019) also provided professional development for the implementers of the intervention, which included preschool directors and teachers who participated in a one-hour training on the theory and structure of the phonemic awareness (PA) and letter sound knowledge (LSK) intervention. The implementers were also given the intervention resources, including the instruction manuals, books, teaching logs, suggested activity dialogue, and information around the program goals and content. They were also provided with one hour of weekly coaching from the research team and speech language pathologists.

Another challenge to implementing effective print-based instruction to support preschool children's literacy development is the lack of literacy-focused curricula in preschools. Many preschools adopt non-literacy focused curricula (e.g., Creative Curriculum) and do not have the tools and resources to effectively teach alphabet knowledge, print concepts, and the alphabetic principle in explicit and systematic ways. Even if preschools have adopted a non-literacy focused curriculum, they may choose to adopt a literacy intervention (e.g., Nemours BrightStart!, Tender Shoots, Foundations for Literacy, etc.) or to enact a systematic program based on some of the research in this review. For example, allocating 10-15 minutes daily to teach PA and LSK in small groups using an evidence-based scope and sequence for teaching letters and PA skills (i.e., blending, segmenting, rhyming) could lead to effective print-based outcomes for children.

Limitations

There were some limitations in this review. First, there were only five studies that investigated populations of students with a disability and only five studies that examined populations of English learners/dual language learners. While some patterns emerged in the existing studies, the small sample size did not allow for more robust findings specific to these student populations. Further, while the inclusion of 21 studies is a moderate size to ascertain effective practices to support print development in preschool students, the inclusion of more studies would have also allowed for more robust results and patterns across a larger sample.

Second, the development of learning print must go hand in hand with the teaching of phonological and phonemic awareness (Roberts et al. 2019; Moats & Tolman, 2019). The scope of this review did not include studies that examined PA interventions, therefore, the findings on print knowledge can seem to stand alone. It is imperative to note that the conclusion of this review in any way suggests that alphabet knowledge and print concepts should be taught as visuals only or for preschool children to memorize letter names and letter sounds in isolation only; but that PA must be taught in tandem with alphabet knowledge and print awareness.

Future Research

Although the exploration of teachers' beliefs and knowledge of early print domains and skills was not a part of the scope of this review, future studies could investigate the current trends among preschool teachers' beliefs and knowledge. Education policies have shifted in recent years and have increased the expectations for preschool teachers and student outcomes (Campbell, 2021). For some preschool teachers, the belief that teaching preschool children letter name and sound knowledge and how print works in consistent and systematic methods (e.g., daily small groups) may not be in line with what they view as developmentally appropriate for three-, four-, and five-year-old children. Thus, it is important to understand how the shifts in policies and academic expectations can impact whether a highly effective intervention program is implemented and to what degree. The findings from this systematic review demonstrate that preschool students can effectively learn print-based knowledge that allows them to be ready for kindergarten through intentional, explicit code-based instruction. Yet, the scope of research could expand to preschool teachers' beliefs and knowledge as well as the levels of support they currently receive in terms of curricula, resources, and professional development.

Conclusion

The findings from this review demonstrate that explicit and targeted print-based instruction can lead to the development of print awareness, letter knowledge, and the alphabetic principle among preschool children. Consistent instruction (e.g., weekly lessons) in Tier 1 or Tier 2 settings can lead to significant outcomes. Explicit instruction followed by play-based learning, games, and activities can provided students with the opportunities to practice their print skills to further solidify their understanding. Across the 21 studies, all instruction involved a knowledgeable other that taught specific skills, while some of them included time for children to play games or engage in activities for practice.

In addition to explicit and systematic print-based instruction, shared reading practices were found to be effective in teaching print concepts and alphabet knowledge. When pointing out letters, beginning sounds, reading left to right and top to bottom, children begin to understand how print works in the context of reading a book. Helping preschool students to see that the words are read and the pictures or illustrations support the text, they can learn that words can be decoded which can help them start to understand the alphabetic principle.

Lastly, the dosage, instructional setting, and implementer type were factors related to the effectiveness of print instruction. Teachers, researchers, parents / caregivers, and community aids were found to be effective implementers of interventions. Tier 1 (whole group) instruction was found to be effective for preschool children to learn letters names, letter sounds, and print awareness. Consistent whole group routines and instruction on targeted letter knowledge and print concepts can lead to significant learning outcomes for preschool children. However, small group instruction and one-on-one settings were also effective strategies to teach print skills. Weekly lessons that are relatively short (i.e., 30 minutes on average) were found to be effective in teaching children explicit print knowledge. A key takeaway from this systematic review is that preschool children need to be explicitly shown how print works and the names of letters and their corresponding sounds. Once they are provided with clear models, demonstrations, and explicit instruction, allowing them time to engage in print-based games and play-based activities in centers or in small groups can further solidify their learning.

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**Denotes one of the 21 studies reviewed*