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Effects of Read It Again! In Early Childhood Special Education Classrooms as Compared to Regular Shared Book Reading

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Abstract

Read It Again! PreK (RIA) is a whole-class, teacher-implemented intervention that embeds explicit language and literacy instruction within the context of shared book reading and has prior evidence of supporting the language and literacy skills of preschool children. We conducted a conceptual replication to test its efficacy when implemented in early childhood special education classrooms relative to regular shared book reading. The randomized controlled trial involved 109 teachers and 726 children (341 with disabilities and 385 peers). Compared to the rigorous counterfactual condition, RIA significantly increased teachers' provision of explicit instruction targeting phonological awareness, print knowledge, narrative, and vocabulary during shared book readings but had limited impact on children's language and literacy skills. Findings underscore the need to conduct replication studies to identify interventions that realize effects for specific populations of interest, such as children with disabilities served in early childhood special education classrooms.

Keywords

language and literacy intervention, early childhood special education, preschool curricula, emergent literacy, shared book-reading intervention

Children's early language and literacy skills lay a critical foundation for later reading success (National Early Literacy Panel [NELP], 2008). Both meaning-based skills, such as vocabulary and narrative skills, and code-based skills, such as print awareness, letter knowledge, and phonological awareness, are related to children's later reading performance. As such, researchers have long been concerned with how to promote these important early language and literacy skills for preschool children at risk for less than optimal academic development, namely children from

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low-income homes and those with identified disabilities, who often arrive to kindergarten with low language and literacy skills (Justice et al., 2015; Kopack Klein, Aikens, Malone, & Tarullo, 2018). Classroom interventions delivered by early childhood teachers can improve the language and literacy skills of young children from low-income homes, with studies showing effects lasting into school-age (Piasta, Justice, McGinty, & Kaderavek, 2012; Wasik & Hindman, 2011). Yet, to the best of our knowledge, only one whole-class language and literacy intervention has focused on preschool children with disabilities (Wilcox, Gray, Guimond, & Lafferty, 2011). This is problematic because children with disabilities represent a significant number of children in early childhood classrooms (9% of females, 20% of males; National Center for Education Statistics [NCES], 2016). In addition, the vast majority (89.5%) of preschool children with disabilities are enrolled in early childhood special education (ECSE) classrooms (Markowitz et al., 2006). ECSE classrooms are those that provide special education services to 3- to 5-year-old children with identified disabilities in the least restrictive environment (either inclusive or self-contained) and enable states to comply with federal regulations per the Individuals with Disabilities Education Improvement Act. Given the large numbers of children with disabilities served within ECSE classrooms, it is imperative to have effective interventions for this context.

Read It Again! PreK (RIA) is a whole-class intervention that may support the language and literacy skills of preschool children with disabilities in ECSE classrooms. Previous studies provide evidence that RIA improved the skills of preschool children, including those who were at risk for later reading difficulties (Bleses et al., 2018; Justice et al., 2010; Mashburn, Justice, McGinty, & Slocum, 2016; McNamara, Vervaeke, & Van Lankveld, 2008). To date, however, there has been no rigorous randomized controlled trial (RCT) that has examined the effects of RIA for children with disabilities. Thus, the aim of this study was to conduct a conceptual replication (Chhin, Taylor, & Wei, 2018) of previous RIA research, whereby we employed a strong counterfactual comparison condition (i.e., reading of same books on same schedule along with general professional development) to examine whether RIA is effective for young children with disabilities, provide further evidence concerning effects of RIA for children who are typically developing, and investigate whether RIA promoted ECSE teachers' provision of explicit language and literacy instruction as a potential mechanism for affecting children's outcomes.

Need for ECSE Language and Literacy Interventions

Early childhood teachers who serve children at risk for difficulties due to low language and literacy skills often exhibit minimal use of evidence-based language and literacy practices (Justice, Mashburn, Hamre, & Pianta, 2008; LoCasale-Crouch et al., 2007; Sawyer et al., 2018). Limited research is specifically available on instructional quality for children with disabilities; some research shows that ECSE classrooms exhibit low instructional quality (Buysse, Wesley, Bryant, & Gardner, 1999; Guo, Sawyer, Justice, & Kaderavek, 2013; Pelatti, Dynia, Logan, Justice, & Kaderavek, 2016; cf. Hestenes, Cassidy, Shim, & Hegde, 2008; Spear et al., 2018). Nonoptimal instruction may partially explain results from the Pre-Elementary Longitudinal Study, indicating minimal improvement in the language and literacy skills of preschool children with disabilities (Carlson et al., 2008). As such, we need evidence-based language and literacy interventions to support ECSE teachers' instructional practices and children's skills.

Although there is limited research on teacher-implemented interventions in ECSE classrooms, research in early childhood classrooms characterized by high concentrations of children with low language and literacy skills has shown that curricular interventions increase children's skills (Fantuzzo, Gadsden, & McDermott, 2011; Justice et al., 2010; Lonigan & Phillips, 2016) as well as the quality of teachers' instruction, as represented by higher scores on the Classroom Assessment Scoring System (CLASS), and specific language and literacy instructional practices (e.g., frequency of print referencing strategies or asking open-ended questions; Piasta et al., 2010; Wasik, Bond, & Hindman, 2006; Wasik & Hindman, 2011). The latter is often the presumed mechanism by which curricula achieve effects, yet few studies have explicitly examined whether changes in instruction were related to children's language and literacy gains. One exception is the work of Wasik and colleagues (Wasik et al., 2006; Wasik & Hindman, 2011), in which the authors not only found effects of their intervention on both classroom quality and children's receptive and expressive vocabulary and phonological awareness, relative to controls, but also associations between instructional practices and children's language gains.

It is unclear whether these curricular interventions realize effects for children with disabilities, who likely require more intensive and explicit instruction than children who are typically developing (Greenwood et al., 2015; Harn, Linan-Thompson, & Roberts, 2008; Simmons et al., 2007). Although some studies have reported positive intervention effects for a subsample of children with disabilities, the numbers of children with disabilities were small (approximately 10% of the sample size; Fantuzzo et al., 2011; Wasik et al., 2006; Wasik & Hindman, 2011). Replication with a larger sample of children with disabilities, such as those served in ECSE classrooms, is necessary. In general, the body of literature on teacher-implemented language and literacy interventions specifically for children with disabilities is minimal, and interventions have typically been delivered in 1:1 sessions (Christensen-Sandfort & Whinnery, 2013; Gianoumis, Seiverling, & Sturmey, 2012; Kaiser, Hester, Alpert, & Whiteman, 1995; Kaminski, Powell-Smith, Hommel, McMahon, & Aguayo, 2014). Yet, it is very challenging for teachers to provide instruction to individual children or even small groups of children (Farley, Piasta, Dogucu, & O'Connell, 2017; Kaminski et al., 2014). As teachers are far more likely to provide whole-group instruction (Early et al., 2010; Sawyer et al., 2018), there is a need for effective language and literacy interventions that can be delivered by ECSE teachers in a whole-class format to children with disabilities alongside their typically developing peers.

To the best of our knowledge, only one whole-class, teacher-implemented intervention exists for the purposes of supporting the language and literacy development of children with disabilities. Wilcox and colleagues (2011) developed and examined Teaching Early Literacy and Language (TELL), a universal comprehensive language and literacy curriculum designed for children with developmental speech and language impairments as well as children who are typically developing. TELL focuses on four code-based skills (i.e., phonological awareness, alphabet knowledge, print concepts, and writing) as well as vocabulary and complex language and embeds instruction within at least five activity structures each day. Children in TELL classrooms significantly outperformed children in control classrooms on vocabulary, print knowledge, and phonological awareness. Although TELL results are positive, teachers may desire alternative interventions that supplement, rather than replace, their classroom curricula.

Read It Again! PreK

RIA may be of interest to ECSE teachers as a supplemental language and literacy intervention that can be used alongside any other classroom curriculum, is delivered in a feasible, whole-class format within the familiar context of shared book reading, and is freely available for download (with self-study professional development materials; http://earlychildhood.ehe.osu.edu/research/practice/read-it-again-prek/). Teachers implement two RIA lessons per week for 30 weeks (i.e., 60 lessons total) using commercially available storybooks. RIA lessons follow a systematic scope and sequence and embed explicit instruction in key meaning-based skills (i.e., narrative and vocabulary) and code-based skills (i.e., print knowledge and phonological awareness) within shared book reading. Lessons are approximately 20 minutes in duration and soft scripted. Importantly, RIA encourages teachers to differentiate instruction through scaffolding; each lesson includes a learner's ladder with examples of how to provide more or less support to help children meet lesson objectives.

Early evidence of the promise of RIA comes from a quasi-experimental study with 20 early childhood education teachers and 137 preschool children (9% with disabilities) in low-income rural programs (Justice et al., 2010). Children in 11 RIA classrooms had better vocabulary, phonological awareness, and print awareness outcomes than children in business-as-usual control classrooms, with small to moderate effect sizes; no significant differences were found in alphabet knowledge. Subsequently, RIA was compared to business-as-usual controls in two larger RCTs. In one RCT with 506 preschool children (none with identified disabilities) enrolled in programs serving a rural, primarily low-income area, children experiencing RIA had significantly higher print awareness relative to control (Mashburn et al., 2016). In addition, children in RIA classrooms characterized by lower language and literacy instructional quality, relative to the full sample and as measured by CLASS, had significantly higher print and alphabet knowledge than children in similar control classrooms. In another RCT, Bleses and colleagues (2018) adapted RIA for small-group instruction in Danish preschools (renamed SPELL) and implemented it at scale with 5,350 preschool children (15% from low-income homes; disability status not reported). Children experiencing RIA had significantly higher phonological awareness and letter knowledge outcomes compared to children in control classrooms; effect sizes were small. Neither RCT detected the effects of RIA on meaning-based skills.

To date, the effects of RIA for children with disabilities have been examined in a single study, although with a small sample and in a nonclassroom setting. McNamara and colleagues (2008) conducted an RCT in which 13 children with language impairment received an adapted version of RIA implemented one-to-one by speech-language pathologists over 12 weeks; 13 children assigned to the control received business-as-usual speech-language services. Children experiencing RIA showed greater gains in alphabet knowledge, phonological awareness, and print knowledge compared to children in the control condition, with medium effect sizes.

The Present Study

Based on these promising results, we conducted a rigorous RCT to examine the effects of RIA for children with disabilities and children who are typically developing in ECSE classrooms as well as the effects of RIA on teachers' practice. In doing so, we not only address the need for classroom-based language and literacy interventions for children with disabilities but also respond to recent calls to conduct replication studies (e.g., see special issue of Remedial and Special Education, 2016, volume 37[4]; recent funding announcements from the National Institutes of Health and Institute of Education Sciences). Replication studies are important for strengthening the intervention evidence base, determining the generalizability of interventions and, in particular, gauging intervention effectiveness for children with disabilities. However, recent literature reviews suggest that less than one percent of studies in special education journals were clearly identified as replications (Lemons et al., 2016; Makel et al., 2016). Our study is a conceptual replication of previous RIA studies, rather than a direct replication, because we systematically altered three key components of previous RIA studies (Chhin et al., 2018). First, we intentionally included both children with disabilities and their typically developing peers in the sample, as both may be served in ECSE classrooms (i.e., although some ECSE classrooms serve only children with disabilities, many utilize an inclusion model in which peers are also enrolled). Second, we employed a stronger counterfactual to isolate the effects of RIA from business-as-usual shared book reading. Given that some literature indicates that preschool children equally benefit from business-as-usual teacher read-alouds compared to book-reading interventions (e.g., dialogic reading; Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999), teachers in both conditions read the same set of books on the same schedule. We also guarded against Hawthorne effects (Shadish, Cook, & Campbell, 2002) by providing comparison teachers with an initial professional development, based on CARA's Kit: Creating Adaptations for Routines and Activities

(Milbourne & Campbell, 2007), that was equivalent in time to the RIA 1-day professional development workshop. Third, beyond examining RIA's effects on children's skills, we also investigated whether RIA indirectly affected children's language and literacy skills through its effects on teachers' instruction.

We addressed three research questions: (1) To what extent does RIA affect ECSE teachers' provision of explicit instruction targeting print knowledge, phonological awareness, narrative, and vocabulary? (2) To what extent does RIA affect print knowledge, phonological awareness, narrative, and vocabulary skills of children, with and without disabilities, served in ECSE classrooms? and (3) To what extent does RIA indirectly affect children's skills through its effect on ECSE teachers' provision of explicit language and literacy instruction?

Method

Participants

We recruited two sequential cohorts of teachers and children from ECSE classrooms in two states to participate in the study. Participating teachers (n = 109) were an average of 42.1 years old (SD = 10.3) and predominantly female (92%). Most (89%) were White, and the remainder were Black (5%), Hispanic or Latinx (3%), and of other or multiple races (7%). All held at least bachelor's degrees, with 58% also holding graduate degrees. On average, teachers had 4.2 years (SD = 0.9) of preschool teaching experience. Seventy percent held state credentials to teach special education. Teachers taught across urban (47%), suburban (32%), and rural (21%) areas and within full-day (40%), half-day (52%), and mixed half/full-day (8%) programs. The average class size was 13 (range = 3-29; SD = 5.6), and 7% to 100% of children in these classrooms had identified disabilities (M = 63%, SD = 30%). Twenty-seven percent were self-contained ECSE classrooms. Seventy-two percent of classrooms were affiliated with local public schools, and 28% were affiliated with Head Start programs.

All children in participating teachers' classrooms experienced RIA lessons; within each classroom, we followed a multistep process to select a subset of up to 10 children to complete study assessments. First, we distributed project information, consent forms, and a brief questionnaire to caregivers of all children in the classroom; only children whose caregivers voluntarily consented were considered eligible. Second, we applied additional eligibility criteria to ensure that the selected children would be able to participate in study assessments; specifically, we used caregivers' responses to the questionnaire to verify that children were verbal (i.e., mean length utterance of at least 2), able to speak and understand English with basic proficiency and did not have any impairments so severe such that study assessments would be considered inappropriate/invalid. Third, we restricted the sample to only those children who were at least 3 years old. From this pool of eligible children, we split the sample into those who had diagnosed disabilities (i.e., individualized education plan [IEP] on file) and those considered to be typically developing peers (i.e., no IEP and caregivers did not report any diagnosed disabilities or any sensory, physical, cognitive, or behavioral difficulties that negatively affected learning or participation in classroom activities). Starting with children who were at least 4 years old, we randomly selected up to six children with disabilities and up to four typically developing peers from each classroom. If this process yielded fewer than six children with disabilities or four typically developing peers in a given classroom, we randomly selected additional children from those who were eligible but only 3 years old. The final sample of children selected to participate in study assessments included 341 children with disabilities and 385 typically developing peers. Sixteen percent of classrooms had five or more children with disabilities who participated in this analytic sample, 53% had three or four children with disabilities who participated, and 32% had fewer than three children with disabilities who participated.

Children were 52.4 months old on average (*SD* = 6.4) and primarily boys (59%). Most (65%) were White, 20% were Black, 17% were Hispanic or Latinx, and 15% were of other or multiple races. The highest degrees earned by children's mothers included a high-school diploma (51%), associate's degree (13%), bachelor's degree (13%), or graduate degree (13%); 10% of mothers did not hold a high-school diploma. For 35% of children, annual family incomes were $25,000 or less; 37% had family incomes between $25,001 and $75,000, and 28% had family incomes higher than $75,001. For children with diagnosed disabilities, parents reported the primary disability for which the child was receiving services: speech or language impairment (28%); developmental delay (16%); autism spectrum disorder (9%); emotional disturbance (0.9%); specific learning disability (0.9%); intellectual disability (0.6%); visual, hearing, orthopedic, or other health impairment (4%); or multiple disabilities (22%). Parents did not report specific diagnoses for the remaining 19% of children with disabilities.

Intervention Procedures

The lead author used the random function in Excel to randomly assign participating teachers to RIA or comparison conditions, with random assignment blocked by state and restricted to force equal sample sizes (Shadish et al., 2002). Children participated in the condition to which their teacher was assigned.

Read it again! RIA teachers received the RIA curriculum (manual and lessons) plus the accompanying 15 commercially available children's books. These teachers participated in an 8-hour, face-to-face RIA workshop prior to implementation as well as a 3-hour, mid-year refresher workshop. The RIA workshop informed teachers of the importance of targeted language and literacy skills (print knowledge, phonological awareness, narrative, and vocabulary), provided step-by-step guidance in implementing RIA lessons, and offered opportunities to practice lessons in small groups. RIA teachers were instructed to implement the full 30-week RIA curriculum, providing two lessons per week as part of whole-class instruction (i.e., 60 lessons total). Caregivers of children in RIA teachers' classrooms also received four of the books used in RIA, receiving one book every 6 weeks, and were encouraged to read these to their child once a week.

RIA teachers tracked their implementation by completing lesson logs (not submitted by five teachers); these logs showed that, on average, teachers implemented 38 of 60 (63%) RIA lessons (range = 6-60). Six teachers implemented fewer than 25% of the 60 RIA lessons, eight implemented between 25% to 50% of lessons, 18 implemented between 50% and 75% of lessons, and 17 implemented between 75% and 100% of lessons. Such variability in implementation was expected, given the authentic ECSE classroom context, and typical of the range evidenced in prior RIA classroom-based studies albeit with a slightly lower average (63% compared with 66%-83%; Bleses et al., 2018; Justice et al., 2010; Mashburn et al., 2016). Lessons averaged 21 minutes (*SD* = 5.8), commensurate with the intended duration. As described below, teachers also videotaped their lesson implementation every other week and submitted these to the research staff. Staff selected 5 of the 30 RIA weeks and coded videos submitted during those weeks for adherence to key lesson components (interrater reliability calculated via intraclass correlation [ICC] for 12% of videos randomly selected for double coding = .91). Adherence on individual lessons ranged from 0.7% to 100% (*M* = 71%, *SD* = 22%) and was negatively skewed: Adherence was at or above 70% for 64% of coded lessons, between 50% and 70% for 20% of coded lessons, and less than 50% for 19% of coded lessons. When considering teachers' adherence across lessons, adherence averaged 70% (*SD* = 17%; range = 29%-93%), with most teachers scoring at or above 70%, 11 teachers scoring between 50% to 70%, and 6 teachers scoring below 50% adherence.

Comparison. As previously stated, a central aim of the study was to examine the effects of RIA on teachers' practices and children's skills when compared to a strong counterfactual. As such, teachers assigned to the comparison condition received the same 15 commercially available children's books used in RIA and were instructed to read these books twice per week as they typically would (i.e., not using RIA). In other words, RIA and comparison teachers were reading the same books on the same schedule for 30 weeks. To counteract a Hawthorne (or novelty) effect, comparison teachers also participated in a similar amount of initial professional development, although there was no mid-year refresher; their professional development was based on CARA's Kit: Creating Adaptations for Routines and Activities (Milbourne & Campbell, 2007) to help with classroom adaptations and accommodations for children with disabilities. Comparison teachers also maintained logs; on average, they completed 39 shared book readings (range = 4-59).

Data Collection and Measures

Two types of data are central to this study. First, teachers in both conditions video-recorded their lesson/shared book-reading implementation every other week; we coded two videos to measure teachers' provision of explicit instruction on the four RIA targets. Second, research staff conducted individual assessments with selected children in the fall and spring of the preschool year. We also collected additional data to serve as covariates in analyses.

Explicit instruction on RIA targets. Research staff applied the Explicit Language and Literacy Instruction and Scaffolding Coding Scheme (ELLIS) to teachers' Week 4 and Week 22 videos to code the extent to which teachers targeted phonological awareness, print knowledge, narrative, and vocabulary during their lessons/shared book readings. ELLIS is an expanded version of the Explicit Language and Literacy Instruction Techniques coding scheme used in previous studies of RIA (Piasta, Justice, McGinty, Mashburn, & Slocum, 2015). ELLIS captures the number of times during a lesson/shared book reading that teachers use any of nine instructional strategies or scaffolds (i.e., identify/orient, define/elaborate, reinforce, generalize, reason, predict, elicit, reduce choices, and co-participate) to provide explicit instruction on one of the four RIA targets; these map to those used in the RIA soft-scripted lessons. Coding occurs at the utterance level and only extra-textual talk (i.e., talk beyond reading the book text) is coded. The number of times that teachers provided explicit instruction on each RIA target was averaged across the Week 4 and Week 22 videos such that each teacher had a single score for each target (print knowledge, phonological awareness, narrative, and vocabulary) that represented the typical amount of instruction afforded to the target during a lesson/shared book reading.

Prior to coding, research staff read the ELLIS manual, reviewed an ELLIS training powerpoint, practiced coding eight master-coded videos, and achieved Cohen's kappa >.80 on three master-coded reliability videos. Ongoing interrater reliability was evaluated by double coding a randomly selected 10% of videos; for print knowledge, phonological awareness, narrative, and vocabulary coding, respectively, ICCs were .99, .97, .96, and .81.

Children's language and literacy skills. Children completed a battery of cognitive and emergent literacy assessments. This included the assessments described below, which measured skills most aligned with the targets of RIA (print knowledge, phonological awareness, narrative, and vocabulary) and were selected a priori to serve as primary outcome measures. All assessments were standardized, appropriate for preschool-aged children and required no more than 15 minutes to administer. We measured *print knowledge* via two assessments. Children's print awareness was measured using the Preschool Word and Print Awareness assessment (Justice, Bowles, & Skibbe, 2006). Within the context of an adult-child shared storybook reading, children are asked to respond to prompts that their knowledge of 14 concepts about print (e.g., *Show me the front of the* *book. Show me one letter on this page*). Children receive points for each correct response, which are summed and converted to an item response theory (IRT)-based scaled score with a mean of 100, *SD* of 15, and range of 46 to 161. IRT-derived reliability is .74 (Justice et al., 2006). Children's letter knowledge, a specific aspect of print knowledge, was measured using the Uppercase and Lowercase Letter Recognition subtests of the Phonological Awareness Literacy Screening for Preschool (Invernizzi, Sullivan, Meier, & Swank, 2004). Children are shown all 26 letters in a fixed, random order, first in uppercase and then in lowercase and asked to name each letter. Children receive one point for each correct response, with a maximum score of 52. Internal consistency is reported as $\alpha = .77$ to .93 in the manual, and Cronbach's $\alpha = .99$ in the present sample. We measured *phonological awareness* via the Rhyme Awareness subtest of the Prereading Inventory of Phonological Awareness (Dodd, Cosbie, McIntosh, Teitzzel, & Ozanne, 2003). For each item, children are orally presented with four words that are also depicted visually as pictures and asked to select the word that does not rhyme. Children receive one point for each correct response, with a maximum score of 12. Split-half reliability is reported as .82 in the manual; $\alpha = .79$ in the present sample. We measured *narrative* via the information score from the Renfrew Bus Story (Glasgow & Cowley, 1994). Children are read a wordless picture book and asked to retell the story. Retells were audio-recorded and then transcribed and scored by research staff following procedures described in the assessment manual. Information scores represent the quality of the narrative retell in terms of the amount, accuracy, and sequencing of content retold; retells are coded for 12 items worth 1 point and 20 items worth 2 points (maximum of 52 points). Prior to scoring, staff reviewed the manual, transcribed and scored two practice retells, and met a criterion of 85% item-level exact scoring agreement on three additional retells. In addition, staff randomly selected 10% of retells for double coding, achieving an ICC of .98 for the information score. The manual reports test–retest reliability as .79. We measured *vocabulary* using the Definitional Vocabulary subtest of the Test of Preschool Early Literacy (Lonigan, Wagner, & Torgesen, 2007). For each item, children are shown a picture of an object, asked to name the object, and then asked to describe a key function or attribute of the object. Children receive up to two points per item for correct responses, with a maximum score of 70. Internal consistency is reported as $\alpha = .94$ in the manual, and $\alpha = .97$ in the present sample.

Additional measures (covariates). We also collected additional data to serve as covariates in analyses. Teachers completed surveys in the fall of the year to report background and classroom characteristics, including years of preschool teaching experience, level of education, class size, and percentage of children in their classrooms who have disabilities (i.e., have IEPs). Teachers also completed a teacher knowledge assessment developed by Cunningham, Zibulsky, and Callahan (2009). Knowledge-assessment items required teachers to demonstrate their understanding of oral and written language structures relevant to young children's language and literacy development (e.g., counting syllables, identifying consonant blends, and manipulating phonemes). The total maximum score was 19; internal consistency has been reported as .77 in the literature (Piasta et al., 2017) and $\alpha = .64$ in the present sample. At the end of the academic year, teachers reported children's attendance.

Research staff also conducted a videotaped classroom observation in the winter of the year. The observation was scheduled at teachers' convenience and captured 2 hours of typical classroom practice, including a whole-group activity, whole-group shared book reading, and center time. Videos were parsed into 20-minute segments, and three segments were randomly selected to be coded using the CLASS: PreK (Pianta, La Paro, & Hamre, 2006). CLASS rates the quality of teacher–child interactions with respect to Instructional Support, Emotional Support, and Classroom Organization using a scale of 1 (*low quality*) to 7 (*high quality*); we focused on Instructional Support scores in this study, given evidence of associations with children's language and literacy outcomes in some studies (Howes et al., 2008; Wasik & Hindman, 2011).

Table 1. Descriptive Statistics for Key Measures by Condition and by Disability Status.

	Comparison (54 teachers, 352 children)			RIA (55 teachers, 374 children)		
	M	*SD*	Range	*M*	*SD*	Range
Teachers' explicit instruction on RIA targets						
Print knowledge	25.17	18.24	0-90	34.02	24.67	1-105
Phonological awareness	1.33	2.93	0-16	26.60	33.65	0-157
Narrative	40.81	27.72	5-127	64.16	38.87	0-156
Vocabulary	4.17	8.18	0-50	11.56	16.09	0-65
Children's fall scores						
Print awareness	91.56	18.88	46-145	91.99	17.62	46-145
Letter naming	19.79	18.52	0-52	17.55	17.93	0-52
Phonological awareness	2.95	2.81	0-12	2.65	2.56	0-12
Narrative	12.78	8.76	0-42	11.10	7.56	0-34
Vocabulary	39.69	17.70	0-69	40.11	15.75	0-67
Children's spring scores						
Print awareness	105.75	19.98	46-161	106.06	17.76	46-161
Letter naming	30.53	18.64	0-52	30.26	18.12	0-52
Phonological awareness	4.27	3.23	0-12	4.31	3.28	0-12
Narrative	17.43	10.24	0-46	16.20	9.35	0-41
Vocabulary	48.76	14.93	0-68	47.76	13.62	1-68
	Typical peers (385 children)			**Disability (341 children)**		
	M	*SD*	Range	*M*	*SD*	Range
Children's fall scores						
Print awareness	98.91	16.16	46-145	83.68	17.07	46-134
Letter naming	20.64	18.15	0-52	16.36	18.11	0-52
Phonological awareness	3.51	2.91	0-12	2.01	2.17	0-12
Narrative	14.92	8.10	1-42	8.19	6.65	0-30
Vocabulary	47.75	11.61	0-69	30.83	17.18	0-66
Children's spring scores						
Print awareness	112.50	16.50	46-161	98.41	18.57	46-161
Letter naming	35.00	16.13	0-52	25.16	19.33	0-52
Phonological awareness	5.27	3.26	0-12	3.16	2.86	0-12
Narrative	20.98	8.87	3-46	11.69	8.35	0-38
Vocabulary	54.89	8.48	17-68	40.44	15.68	0-68

Note. RIA = Read It Again!

CLASS coders experienced standard CLASS training and met developers' initial reliability standards. In addition, we randomly selected 10% of video segments for double coding, and interrater agreement (within 1 point) was .93.

Results

Descriptive statistics by condition as well as by child's disability status are presented in Table 1 for all key measures. Notably, teachers' provision of explicit instruction on the four RA targets was severely positively skewed (Figure 1). Assumptions of normality were met for all child measures based on the distributions of residuals.

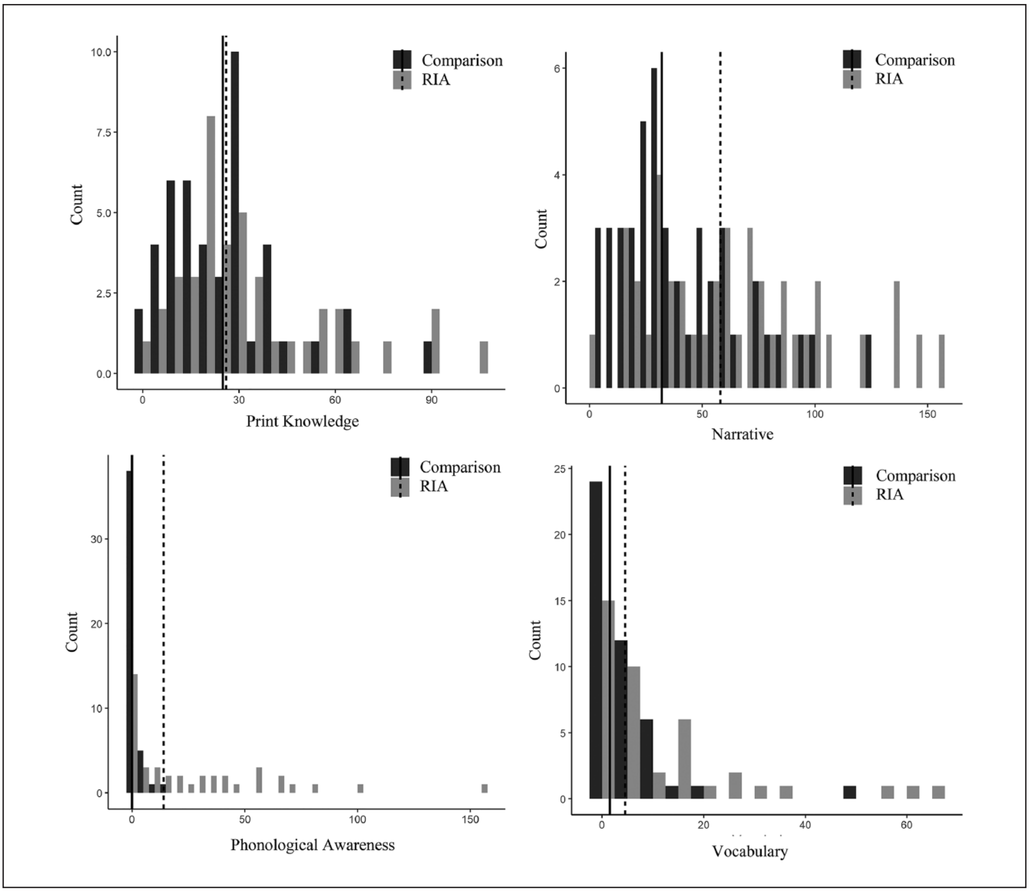


Figure 1. Histograms for teachers' provision of explicit instruction on the four RIA targets.
Note. Solid vertical lines represent the median count for comparison teachers, and dashed vertical lines represent the median count for RIA teachers. RIA = Read It Again!

Prior to conducting our main analyses, we examined characteristics of participating teachers, classrooms, and children (Table 1), including initial equivalence across conditions. As noted in the Participants section, classrooms varied in overall class size and the number of children with disabilities served, partially as a function of varying ECSE regulations across the two states. However, no significant differences were detected between control and RIA conditions at the classroom level. For children, despite random assignment, chi-square and Welch's t tests (as equal variances could not be assumed) indicated differences between RIA and comparison conditions in terms of pretest narrative scores (W[1, 493.77] = 2.33, p = .020), gender (χ^2 [1, N = 726] = 3.88, p = .049), ethnicity (χ^2 [1, N = 664] = 8.42, p = .004), and family income (W[1, 454.70] = 2.94, p = .003), as well as additional trends of differences in age (W[1, 714.06] = 1.89, p = .059), race (χ^2 [2, N = 681] = 5.83, p = .054), and maternal education (χ^2 [4, N = 691] = 9.42, p = .051). We also noted considerable range in children's school attendance (24-238 days; M = 143, SD = 35). Moreover, children with disabilities scored significantly lower than their typically developing peers at pretest: print awareness (W[1, 659.43] = 11.93, p < .001), letter naming (W[1, 662.02] = 3.06, p = .002), phonological awareness (W[1, 649.69] = 7.61, p < .001), narrative (W[1, 519.95] = 10.42, p < .001), and vocabulary (W[1, 529.832] = 14.89, p < .001). Given the results of preliminary analyses, we included the following as covariates in

Table 2. Teachers' Provision of Explicit Instruction on the Four RIA Targets: Results of Negative Binomial Regression Analyses.

	Amount of explicit instruction			
	Print knowledge	Phonological awareness	Narrative	Vocabulary
Intercept	3.14**	0.33	3.71**	1.43**
RIA	0.29*	2.78**	0.42**	0.87**
State	0.00	0.22	−0.09	0.12
CLASS Instructional Support	0.11	0.05	−0.07	−0.11
Master's degree	0.18	−0.04	0.08	0.06
Years of experience	−0.10	−0.08	0.02	0.19
Class size	0.04*	0.02	−0.01	0.02
% IEP	0.27	−0.58	−0.23	−0.54
Knowledge	0.01	−0.01	0.03	0.07
Dispersion	2.10	0.28	2.38	0.45

Note. CLASS = Classroom Assessment Scoring System; IEP = individualized education plan; RIA = Read It Again!, which represents the treatment effect in analyses. All coefficients represent expected log counts. No significance test for the dispersion parameter was conducted.
$^*p < .05$. $^{**}p < .01$.

all analyses: teachers' years of preschool teaching experience, education level (graduate degree or less), language and literacy knowledge, CLASS Instructional Support, the percentage of children in the classroom who had disabilities, class size, and state. For analyses of children's outcomes, we also controlled for child age, gender, minority status due to race or ethnicity, attendance, disability status, fall language, and literacy skills plus the classroom average of these scores, and maternal education level (more or less than a high-school diploma; note that family income was not included as a covariate, given its correlation of .60 with maternal education).

We also examined the extent of missing data for outcome measures. Missing data concerning teachers' explicit instruction on the four RIA targets were 17%; missing data for children's language, and literacy scores ranged from 6% to 28%. To handle missing data, we imputed 20 data sets using the mice package 3.1.0 in R for teacher outcomes (Buuren & Groothuis-Oudshoorn, 2011) and Blimp for child outcomes (Keller & Enders, 2017). We pooled results following Rubin's formulae (Little & Rubin, 2002).

Effect of RIA on ECSE Teachers' Provision of Explicit Instruction

Given that the teacher outcomes were count data and nonnormally distributed (Figure 1), we compared RIA versus comparison teachers' provision of explicit instruction on the RIA targets using negative binominal regression via R 3.4.3 software. We estimated four separate models, one for each target: print knowledge, phonological awareness, narrative, and vocabulary. Models included condition, with the comparison as the reference group, plus all classroom-level covariates noted above, with continuous variables centered at the grand mean. Results are presented in Table 2 and graphically depicted in Figure 1. RIA significantly increased teachers' provision of explicit instruction on all targets (i.e., significant RIA coefficients in Table 2). Modeled results show that RIA teachers tended to target print knowledge 1.34 times (i.e., $e^{0.29}$) more than comparison teachers, with an expected count of 30.88 for RIA teachers and 23.10 for comparison teachers. RIA teachers targeted phonological awareness 16.12 times more than comparison teachers, with expected counts of 16.12 versus 1.00, respectively. RIA teachers targeted narrative 1.53 times more than comparison teachers, with expected counts of 62.18 versus 40.85. RIA teachers targeted vocabulary 2.39 times more than comparison teachers, with expected counts of 9.97 and 4.18.

Effect of RIA on the Language and Literacy Skills of Children Served in ECSE Classrooms

To determine the effect of RIA on children's outcomes, all of which were continuous, we estimated multilevel models in Mplus version 7.11 (Muthén & Muthén, 2006) and compared the spring skills of children in RIA versus comparison conditions. We nested children in classrooms given unconditional ICCs of .24, .18, .16, .14, and .24 for print awareness, letter knowledge, phonological awareness, narrative, and vocabulary outcomes, respectively. We estimated separate models for each of the five outcomes. Models included (a) the corresponding fall score as a covariate (e.g., controlled for fall phonological awareness in estimating spring phonological awareness) at both the child level and aggregated to the classroom mean at the classroom level, (b) condition, with comparison as the reference group, (c) children's disability status, with typically developing peers as the reference group, and (d) all additional classroom- and child-level covariates noted above, with continuous variables grand-mean centered. We also examined models including a condition-by-disability-status interaction to determine whether effects of RIA differed for children with disabilities versus their typically developing peers.

As presented on Table 3 (columns reporting main effect models), RIA did not exhibit significant direct effects on children's outcomes, with effect sizes (d) ranging from −0.08 to 0.06. RIA also did not significantly interact with disability status (final three columns of Table 3), indicating that the effects of RIA did not differ between children with disabilities and their typically developing peers.

Indirect Effects of RIA on Children's Language and Literacy Skills via Instruction

In our final analysis, we estimated a multilevel path model in Mplus 7.11 (Muthén & Muthén, 2006) to examine whether RIA indirectly affected child outcomes via its effects on teachers' provision of explicit language and literacy instruction. For parsimony, we first combined teachers' print knowledge and phonological awareness instruction into the broader category of "code-focused instruction" and combined vocabulary and narrative instruction into the broader category of "meaning-focused instruction" (Connor, Morrison, & Slominski, 2006; Lonigan & Phillips, 2016). Correspondingly, we standardized the five child measures and created two composite outcomes: (a) code-based outcome was an average of print awareness, letter naming, and phonological awareness scores, and (b) meaning-based outcome was an average of vocabulary and narrative scores. We anticipated that RIA would indirectly affect the code-based outcome via code-focused instruction and affect the meaning-focused outcome via meaning-focused instruction.

The path model is depicted in Figure 2, along with fit statistics and path estimates. Note that, although not depicted in the diagram, the analysis also included the child and classroom covariates described above. The model fit reasonably well. Consistent with the findings of previous analyses, RIA significantly impacted teachers' provision of explicit code-focused and meaning-focused instruction (RIA → code instruction and RIA → meaning instruction paths in Figure 2). Teachers' instruction generally did not predict children's outcomes, with one exception: RIA exhibited a small but significant indirect effect on children's code-based outcomes through its effect on teachers' provision of explicit meaning-focused instruction (RIA → meaning instruction → code composite path in Figure 2; $d = 0.12$). Other indirect pathways were nonsignificant with negligible effect sizes.

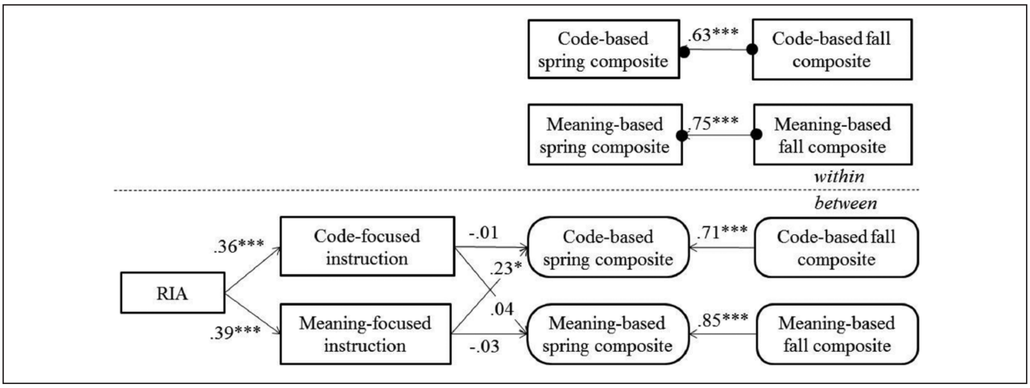
Table 3. Effects of RIA on Children's Spring Language and Literacy Skills: Results of Multilevel Analyses.

	Main effect models							Disability as moderator		
	R^2									
	Within	Between	*b*	*z*	*p*	*d*		*b*	*z*	*p*
Print awareness	.38	.53								
RIA			0.41	0.26	.793	0.02		0.93	0.51	.612
Disability			−5.16	−3.59	<.001			−4.36	−2.22	.026
RIA × disability								−1.31	−0.53	.594
Letter naming	.61	.86								
RIA			1.02	0.91	.366	0.06		1.69	1.31	.192
Disability			−4.56	−4.65	<.001			−3.81	−3.05	.002
RIA × disability								−1.46	−0.88	.380
Phonological awareness	.28	.46								
RIA			0.16	0.55	.581	0.05		−0.02	−0.04	.967
Disability			−0.98	−3.74	<.001			−1.19	−3.50	<.001
RIA × disability								0.37	0.84	.403
Narrative	.60	.89								
RIA			−.04	−0.03	.978	0.00		−0.27	−0.01	.973
Disability			−3.65	−5.51	<.001			−3.77	−4.90	<.001
RIA × disability								0.31	0.33	.743
Vocabulary	.64	.70								
RIA			−1.14	−1.28	.202	−0.08		−0.46	−0.50	.619
Disability			−3.25	−3.78	<.001			−2.90	−2.31	.021
RIA × disability								−1.20	−0.74	.460

Note. Model estimates are combined over 20 imputed datasets. Covariates included fall score of the corresponding outcome measure, child gender, child age, child minority status, child school attendance, child mother's education level, teacher's years of preschool teaching experience, teacher education level, teacher knowledge, classroom instructional support, percentage of children in the classroom who had disabilities, class size, and state. *b* = unstandardized coefficient; *z* = ratio of the parameter estimate to its standard error, used for approximate *z*-test; *d* = Cohen's *d*, effect size for the main effect of RIA as computed in accordance with What Works Clearinghouse (2017) recommendations; RIA = Read It Again!, which represents the treatment effect in analyses.

Discussion

In this study, we examined the effects of RIA as a whole-class, teacher-implemented intervention designed to support the language and literacy skills of preschool children. Our conceptual replication tested whether RIA, shown to impact children's skills in prior studies (Bleses et al., 2018; Justice et al., 2010; Mashburn et al., 2016; McNamara et al., 2008), affected teachers' use of explicit instruction and children's outcomes when implemented in ECSE classrooms. We found that RIA increased teachers' print knowledge, phonological awareness, narrative, and vocabulary instruction during shared book reading. This is important, given the need for explicit attention to these targets (NELP, 2008). However, with respect to outcomes for children with disabilities or their typically developing peers, we found no statistically significant or practically meaningful direct effects of RIA on discrete measures of print awareness, letter knowledge, and phonological awareness, and no effects on meaning-based skills (i.e., narrative and vocabulary). We detected a small indirect effect on a composite of children's code-based skills, in which RIA meaning-focused instruction affected code-based skills. Although at odds with our hypothesis, some prior



Model estimates	*b*	*B*	*z*	*p*	*d*
Direct effects					
Code instruction → Code composite	0.00	−.01	−0.05	.959	
Code instruction → Meaning composite	0.00	.04	0.39	.697	
Meaning instruction → Code composite	0.01	.23	2.41	.016	
Meaning instruction → Meaning composite	0.00	−.03	−0.29	.773	
RIA → Code instruction	28.81	.36	3.71	<.001	
RIA → Meaning instruction	32.57	.39	3.45	.001	
Indirect effects					
RIA → Code instruction → Code composite	−0.01	.00	−0.07	.947	0.00
RIA → Code instruction → Meaning composite	0.02	.01	0.38	.702	0.02
RIA → Meaning instruction → Code composite	0.16	.09	2.00	.045	0.12
RIA → Meaning instruction → Meaning composite	−0.01	.01	−0.30	.762	−0.01

			SRMR	
Model fit	RMSEA	CFI	within	between
	0.086	0.933	0.029	0.056

Figure 2. Effects of RIA on children's spring language and literacy skills as mediated by teachers' instruction on RIA targets.

Note. Multilevel path model estimates are combined over 20 imputed data sets. Additional covariates (not depicted) included child gender, child age, child minority status, child school attendance, child mother's education level, teacher's years of preschool teaching experience, teacher education level, teacher knowledge, classroom instructional support, percentage of children in the classroom who had disabilities, class size, and state. *b* = unstandardized coefficient; *B* = standardized coefficient; *z* = ratio of the parameter estimate to its standard error, used for approximate z-test; *d* = Cohen's *d*, effect size for the main effect of RIA, as computed in accordance with What Works Clearinghouse (2017) recommendations; RIA = Read It Again!.

work suggests that meaning-focused skills may affect acquisition of code-focused skills (Storch & Whitehurst, 2002) and associations between teachers' meaning-focused talk and children's later code-focused skills (Dickinson & Porche, 2011).

We interpret these results within the context of prior findings concerning RIA and the context of this conceptual replication. With respect to prior findings, although an initial quasi-experiemental study evidenced impacts of RIA on vocabulary outcomes (Justice et al., 2010), previous RIA RCTs also showed no effects on meaning-based skills (Bleses et al., 2018; Mashburn et al., 2016), making this finding disappointing but not altogether surprising. All prior RIA studies evidenced direct impacts on print awareness, letter knowledge, and/or phonological awareness, however. One explanation for our lack of effects is the more rigorous counterfactual, in that this study attempted to disentangle any added benefit of RIA over and above effects of typical shared book reading. Although some work suggests additional benefits of embedding explicit instruction into shared book reading (Justice, Kaderavek, Fan, Sofka, & Hunt, 2009; Pollard-Durodola et al., 2011; Whalon, Martinez, Shannon, Butcher, & Hanline, 2015), the current results are more aligned with other work questioning the added value of such instruction (Lonigan et al., 1999). Moreover, we provided comparison teachers with an 8-hour professional development on making adaptations and accommodations in their classrooms for children with disabilities. Although teachers reported similar levels of child engagement during shared reading in their logs (M_{RIA} = 2.56, $M_{\text{comparison}}$ = 2.49 on a 3-point scale), it is conceivable that comparison teachers made accommodations that better afforded learning from this activity.

In addition, we deliberately sampled ECSE classrooms and children with disabilities in this conceptual replication, as effects for this population were previously unknown. Notably, we found that teachers implemented 63% of lessons with 70% adherence, on average, in these ECSE classrooms. Compared with previous classroom-based trials of RIA (Bleses et al., 2018; Justice et al., 2010; Mashburn et al., 2016), this suggests that teachers in ECSE settings may find RIA slightly more challenging to implement; such challenges were also anecdotally reported to the research team. Our findings thus speak to the effects of RIA as realistically implemented in ECSE classrooms when supported by the RIA materials and accompanying 11-hour professional development workshops. Although we cannot determine effects of RIA under optimal implementation, this work is nonetheless important, given that it may not be reasonable to expect perfect or unaltered implementation in real-world classrooms (Durlak & DuPre, 2008) along with educational decision makers' need for information about intervention effects as used in authentic settings by teachers (Institute of Education Sciences, 2018). An important future direction is to carefully consider the implementation practices of RIA, defined as the methods used to increase end users' adoption and use of the intervention (Dunst, Trivette, & Raab, 2013). Given that practices sufficient to produce effects in the past were insufficient within ECSE classrooms, supports may need to be modified for this context, and the effects of RIA may change with increased implementation.

Our results also cause us to consider whether the intensity of RIA, as a brief and supplemental whole-class intervention and as enacted in this study, is sufficient to produce language and literacy effects for children with disabilities, who may require greater instructional intensity than their peers (Harn et al., 2008). Although prior work suggested positive effects for children with language impairment when provided with only 12 RIA sessions, this instruction may have been intensified through one-on-one delivery (McNamara et al., 2008). Moreover, despite impacts on teachers' instruction on all RIA targets, it is unclear whether the instructional levels achieved were of sufficient intensity to impact children's outcomes. Many teachers in this study fell short of the 20 to 40 instances of explicit print knowledge instruction that have been shown to affect children's outcomes (Justice et al., 2009; Piasta et al., 2012), and a disconcerting number of teachers did not provide any instances of explicit phonological awareness or vocabulary instruction. Research recommends 5 to 10 minutes per day of phonological awareness instruction (Phillips, Clancy-Menchetti, & Lonigan, 2008) and 5 to 7 exposures to learn a new vocabulary word (Nation, 2001) for children who are typically developing; thus, children with disabilities would likely require a greater dosage of explicit instruction. Although we can hope that teachers were meeting these benchmarks outside of RIA, further exploration as to the intensity of instruction necessary to realize child impacts is warranted (e.g., threshold analyses; Burchinal, Zaslow, & Tarullo, 2016) to inform refinement of RIA and development of other effective curricula. The lack of effects on children's meaning-based skills, in particular, parallels other studies highlighting the challenges of promoting preschool children's language skills via classroom-based intervention (Dickinson, 2011; Haley, Hulme, Bowyer-Crane, Snowling, & Fricke, 2017); these skills should be a focus of continued intervention development work.

In addition to providing information concerning RIA effects and implications for future research and intervention design, this study makes two key contributions. First, this work contributes to important ongoing conversations about replication (Chhin et al., 2018; Makel et al., 2016). Our results underscore the need to systematically test interventions in different settings and populations, as what may produce effects in one context may not realize similar effects in another context. Second, this work applies recommendations from implementation science to more carefully attend to intervention mechanism (Dunst et al., 2013). Unlike prior RIA RCTs, we were able to isolate the effects of RIA from effects of reading the same commercially available books; our results imply that effects in prior studies may have been due to the shared reading component rather than the RIA lessons. We also considered teachers' provision of explicit language and literacy instruction as a possible mechanism by which RIA achieves effects, which was only somewhat supported by our results. This work thus highlights the need to identify and test "active ingredients" of interventions and models using a rigorous counterfactual and mediation analysis. Overall, this study urges continued work to develop and refine language and literacy interventions that effectively support the development of children served in ECSE classrooms.

Authors' Note

The opinions expressed are those of the authors and do not represent views of the Institute or National Center for Special Education Research.

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