

# UC Riverside

## UC Riverside Electronic Theses and Dissertations

### Title

Supplemental Reading Interventions Implemented by Paraeducators

### Permalink

<https://escholarship.org/uc/item/57b4410r>

### Author

Jones, Brian Thomas

### Publication Date

2018

### Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA  
RIVERSIDE

Supplemental Reading Interventions Implemented by Paraeducators

A Thesis submitted in partial satisfaction  
of the requirements for the degree of

Master of Arts

in

Education

by

Brian Jones

December 2018

Thesis Committee:

Dr. Cathleen Geraghty, Chairperson

Dr. Rollanda O'Connor

Dr. Rondy Yu

Copyright by  
Brian Jones  
2018

The Thesis of Brian Jones is approved:

---

---

---

Committee Chairperson

University of California, Riverside

## ABSTRACT OF THE THESIS

Supplemental Reading Interventions Implemented by Paraeducators

by

Brian Jones

Master of Arts, Graduate Program in Education  
University of California, Riverside, December 2018  
Dr. Cathleen Geraghty, Chairperson

The acquisition and utilization of literacy skills is a crucial part of social functioning. Preventative and intensive reading intervention can be administered to at-risk students in a systematic way to help facilitate gains on literacy outcomes. Despite this, barriers to implementation arise. One solution might be the use of paraeducators as providers of supplemental reading instruction. The current study uses meta-analytic procedures to evaluate two major questions: what is the overall effectiveness of paraeducators as implementers of reading intervention? In which areas are paraeducators most effective? A literature search of research from 2001 – 2017 yielded 76 studies. Nine studies met the predetermined inclusion criteria and were coded for demographic information and six common reading outcomes. Results must be interpreted with caution due to issues with sample size and heterogeneity. Spelling and decoding emerge as hopeful areas to inform future research. Other patterns involving grade, ethnicity, and gender are also explored. Implications and limitations are further discussed.

## Table of Contents

Introduction.....	1
Methods.....	9
Results.....	15
Discussion.....	25
References.....	31

## **List of Tables**

Table 1.1: Participant Characteristics by Study.....	16
Table 1.2: Means and Standard Deviations of Outcome Variables.....	18
Table 1.3: Study Effect Sizes by Outcomes.....	20
Table 1.4: Mean Effect Sizes.....	21
Table 1.5: Effect Sizes and Standard Deviations by Grade Level.....	22
Table 1.6: Effect Sizes and Standard Deviations by Ethnic Ratio.....	23
Table 1.7: Effect Sizes and Standard Deviations by Gender Ratio.....	23

## **Introduction**

### **The Importance of Literacy**

Reading is a fundamental part of functioning in modern society. For many, reading happens automatically and unconsciously when they look at a street sign, check a text message, see a funny T-shirt, or a variety of other happenstances that occur in daily life. The skills involved in literacy facilitate the acquisition of knowledge across numerous content domains. According to Lyon et al. (2001), good readers fluently apply phonemic skills and activate their lexicon to connect what they are reading to their prior knowledge and experiences. Literacy is a gateway that provides access to new material, and it invites the reader to think critically about that material. Utilizing literacy skills can become mentally taxing if one or more of them have not been mastered (Perfetti, 1985). Reading processes share a limited amount of resources within an individual's working memory. Higher order reading processes, like comprehension, tend to be resource intensive. If a lower order process, like letter and word recognition, is not automatized, it consumes a disproportionate amount of working memory resources, making higher order processes more difficult to complete.

Jenkins, Fuchs, Van der Broek, Espin and Deno (2003) conducted a study that supported this notion. They tested fourth grade students on measures of reading comprehension and reading aloud, and they found that word level processes, like decoding, contributed to fluency at low levels while comprehension was associated with higher levels of fluency. In other words, those who struggle with decoding tend not to



read fluently, and those who can comprehend words tend to read them more quickly and smoothly.

Students who are struggling readers may be disadvantaged across multiple content areas when compared to students whose reading skills are developing typically.

Stanovich (1986) used the term “Matthew Effect” to describe a growing achievement gap between struggling and typical readers. Those with at least typically developing reading skills will sharpen those skills thus “getting richer” literacy skills and knowledge across content domains. On the other hand, as time passes it becomes increasingly difficult for struggling readers to meet typical grade level expectations and thus “the poor get poorer.”

Juel (1988) gave credence to this notion in a longitudinal study where she identified students who struggled with reading in first grade, reassessed them in fourth grade, and compared them to typically developing readers. She found an 88% chance that students who were struggling readers in first grade would continue to be struggling readers at the end of fourth grade. By the end of the fourth grade, the struggling readers she studied had not achieved the same level of decoding skills that the typically developing readers achieved at the beginning of the second grade. Additionally, the typically developing readers read considerably more than the struggling readers both in and out of school. These findings suggest an urgent need for educators to intervene and provide extra support for struggling readers.

### **Preventative and Intensive Intervention**

In order to mitigate the Matthew Effect, educators must intervene and provide targeted, high-quality literacy instruction to struggling readers. The National Institute of

Child Health and Human Development (2000) recommends direct, explicit instruction in five core literacy components. Phonological awareness is a skill that involves knowledge of linguistic sounds. Phonics is the correspondence of sounds to letters or symbols. Both phonological awareness and phonics facilitate the alphabetic skills necessary to decode new words. Fluency involves automatizing the decoding process so that words and texts can be pronounced smoothly. Vocabulary is understanding the meaning and usage of an individual word. Comprehension involves understanding the meaning of a text. Each successive component is built upon the one before it, so if a student struggles in any of these areas, instruction can be remediated to target the necessary skill. A series of synthesis studies (Wanzek & Vaughn, 2007; Wanzek et al., 2013) analyzed over a decade of reading intervention research to evaluate the overall effectiveness of interventions that targeted specific reading related skills. They found that struggling readers make significant gains when intervention matches their skill deficits. Although intervention was found to be most effective for students in grades three and under, targeted intervention was found to have a positive impact on students in the upper grades as well.

**Demonstrated effects for at-risk groups.** Systematic direct instruction of specific literacy skills can be an effective means to providing intervention to struggling readers. Much of the empirical literature provides evidence that demonstrates the efficacy of systematic direct instruction on specific demographic groups. The following subsections highlight three such examples.

***Kindergarteners.*** One group that can benefit from targeted intervention are students who show signs of reading difficulty in kindergarten. Torgesen et al. (1999)

conducted a longitudinal study of kindergarten students with difficulties pertaining to decoding skills. The students were randomly assigned into a non-treatment control group or one of two treatment groups that provided direct instruction of decoding skills in varying degrees. These groups were regularly assessed by the research team until the students were in second grade. The researchers found that both of the treatment groups outperformed the non-treatment control group. This suggests that kindergarteners who struggle with emerging literacy skills can benefit from direct instruction of specific reading skills.

*Students with low SES.* The second group in which targeted intervention has been demonstrated to be effective are students who come from low socioeconomic backgrounds. Foorman, Francis, Fletcher, Schatschneider and Mehta (1998) studied first and second grade students who possessed deficits in alphabetic skills and attended a school that received Title I funding. Title I in this case refers to federal funding that is provided for students with economically disadvantaged backgrounds with low achievement. Students were then randomly selected into one of two experimental groups. The embedded code group had to infer alphabetic skills by reading passages. The direct code received direct explicit instruction in alphabetic skills. After four months of intervention, the results showed that the direct code group significantly outperformed the embedded code group across all of the measured outcomes. The researchers were able to conclude that direct explicit instruction is an effective means to facilitate gains in students with low socioeconomic backgrounds.

*English language learners.* The third group that benefits from targeted intervention are English language learners (ELL). Kamps et al. (2007) conducted an intervention study of first and second grade ELLs who struggled with early literacy skills. Students who were ELL were either placed into a treatment group which received direct instruction in the areas of phonological awareness, letter recognition, decoding, fluency, and comprehension in addition to their core reading instruction, or a non-treatment control group. At the end of the intervention period, the students were administered early literacy measures, and their scores were compared. The researchers found that students in the treatment condition benefited greatly and made significantly higher gains than those in the control group. This study provides evidence to support the conclusion that the same direct instruction strategies that benefitted other groups of learners (Torgesen et al., 1999; Foorman, Francis, Fletcher, Schatschneider & Mehta, 1998) are also beneficial to students who are ELL.

**Systematic service delivery.** Evidence-based intervention services can be delivered systematically to maximize their effect and reach to as many struggling readers as possible. O'Connor (2000) conducted a two-year study where her team provided intervention to kindergarteners who struggled with emerging literacy skills at four levels, or "layers," of intensity. Layer 1 provided whole-class, systematic direct instruction in the areas of letter knowledge, blending, and vocabulary to students who may not have been exposed to these skills. Students who made poor gains after three months of Layer 1 instruction were placed into Layer 2, which reinforced the same skills in Layer 1 but in short, focused sessions that provided individualized support. In the second year of the

study, students who were in Layer 2 that were underperforming in an academic achievement measure were placed into Layer 3 which consisted of small group instruction in decoding, phoneme segmentation, and blending. After six months of Layer 3, the students who were still performing under average were given Layer 4 support that involved one-on-one instruction focusing on blending and spelling decodable words. This study found each layer of instruction as an effective means to facilitate gains in specific areas of literacy.

### **Problems with Implementation**

Although the field of reading disabilities has been highly researched, issues arise when the rubber meets the road. One such issue involves the amount of time teachers have for instruction. Wanzek and Vaughn (2008) conducted a series of studies to determine how much time in intervention is necessary for struggling readers to make gains on reading outcomes. They found that at least 30-minute sessions were required to facilitate gains. Additionally, they suggested that those who do not respond adequately to intervention may require longer periods of specialized instruction to demonstrate improvement on achievement outcomes. Scruggs and Mastropieri (1996) conducted a synthesis of 37 years' worth of research to investigate teacher thoughts on providing specialized instruction and intervention services. They found that teachers recognize the importance of inclusion and differentiating instruction to meet students' needs, but over two thirds of teachers feel that they do not have the adequate time to provide the necessary services to intervene for students with disabilities.

## **Roles for Paraeducators**

One seemingly untapped resource that can address issues facing implementation of high quality reading instruction are paraeducators. Paraeducators are adults who are employed by a school district to assist teachers in their classrooms and work with students. Although they assist with instruction, paraeducators usually do not hold teaching credentials. Their roles usually include providing one-on-one tutoring support to students, assisting with classroom management, and providing instructional support services under the supervision of a teacher (U.S. Department of Education, 2004). To ensure the quality of the service that they provide, the No Child Left Behind Act of 2001 also clearly requires that paraeducators obtain a secondary education diploma, or an equivalent, and complete either two years of higher education or the requirements for an associate degree.

With their roles clearly defined, paraeducators have the potential to greatly extend the instructional reach of teachers. Causton-Theoharis, Giangreco, Doyle, and Vadasy (2007) liken paraeducators to sous-chefs in their review and offer several ways that they can support direct instruction of literacy skills. In addition to training paraeducators on evidence-based reading and behavioral approaches, the authors suggest that paraeducators should be used to supplement teacher instruction, not supplant it. This is to say that a highly qualified teacher should always provide core instruction, but a paraeducator can provide one-on-one or small group tutoring to complement and reinforce the teacher's lesson. The effectiveness of this approach was demonstrated by Brown, Morris, and Fields (2005) who evaluated one-on-one tutoring as a method to

deliver reading intervention. Tutors could be either teachers or paraeducators. Although all of the tutors were supervised by reading specialists, paraeducator tutors received additional guidance from the teachers that they worked with. Not only did the study find that the treatment group outperformed the control group, but they found that the students who were tutored by paraeducators performed nearly as well as the students who were tutored by teachers.

### **The Current Study**

Direct explicit instruction that targets core literacy skills has been demonstrated to mitigate Matthew effects and facilitate gains for struggling readers across a body of empirical research (Wanzek and Vaughn, 2007; Wanzek et al., 2013). When broken down further, these effects have been replicated for a variety of at-risk groups such as those struggling with emergent literacy skills (Torgesen et al., 1999), those with low socioeconomic status (Foorman et al., 1998), and English language learners (Kamps et al., 2007). Yet, when these methods are implemented, issues arise. One way to remedy these issues is to utilize paraeducators as a supplement to instruction. They have clearly defined roles and have demonstrated to be an effective complement to core instruction.

Supplemental reading interventions implemented by paraeducators have been studied and have shown positive results, but their findings have not been aggregated and evaluated for their overall effects. The current study uses meta-analytic procedure in an attempt to answer two questions: First, what is the overall effectiveness of paraeducator-implemented reading interventions? The second research question asks in which areas of intervention are paraeducators most effective? If the data demonstrate that paraeducators

do have a significantly positive effect on reading outcomes, the current study also seeks to provide insight into how paraeducators might be viable supplementary service providers by assessing what might be moderating these effects.

## **Methods**

### **Inclusion Criteria**

A computer search was conducted using ERIC and PsychINFO to locate intervention studies involving paraeducators that were published between 2001 and 2017. This range was selected to reflect the implementation of the Title I requirements of Paraeducators (U.S. Department of Education, 2004). Depending on the school district or region, paraeducators can be known by several different titles. In order to capture this, many titles were used in the search terms (Instructional assistants, paraeducators, paraprofessionals, title I aides) in combination with reading interventions.

Studies were selected based on the following criteria:

1. The study was reported in English in a peer-reviewed journal and was available on the internet.
2. Participants in the study were students with reading difficulties (i.e. below expected grade level in reading achievement).
3. Interventions were provided as a part of the school day program (not home, clinic, or camp).
4. The dependent variables addressed reading outcomes and were measured with standardized assessment tools (not researcher designed measures).



5. The study was primary research (not a follow-up, synthesis, or a meta-analysis).  
Additionally, since the aim of the current study is to make inferences about the paraeducator workforce in the United States, it is also important that included studies are conducted in the United States.
6. The study was conducted using a group design; either experimental or quasi-experimental.
7. The study had to contain at least one treatment group where intervention was solely provided by paraeducators and one non-treatment control group.
8. Paraeducators were employed by the school district (not volunteers or researchers).

### **Study Selection**

The initial search yielded 76 abstracts. The use of various titles for paraeducators in the search terms lead to fairly broad results. Many studies were related to the use of paraprofessionals in clinical and hospital settings. Explicit statements in the abstracts indicated that 49 studies did not meet criteria. After the studies from both databases were reconciled to eliminate duplicates, 17 studies remained and were further examined to determine if they met criteria. Two studies were excluded because they were follow-up studies. Two studies did not have a treatment group where intervention was solely implemented by paraeducators. One study was not conducted in the United States. One study did not measure outcomes relevant to this current study. One study did not use standardized assessment tools. One did not employ a group design. Thus, a total of nine studies met criteria for inclusion in the current meta-analysis.

## **Interrater Agreement**

Interrater agreement was calculated with the assistance of a school psychology doctoral student who served as a second rater. Of the 17 studies that passed the abstract screening, three (approximately 20%) were selected using a random number generator and evaluated by the second rater. The eight previously mentioned inclusion criteria were applied to determine if the randomly selected sample qualified for the current study. Additionally, the sample was evaluated to determine if there was enough information to calculate effect size for any of the six outcome moderators (Phonological awareness, alphabets, decoding, word reading, spelling, and reading comprehension). Both the author and the second rater were in 100% agreement on the inclusion and effect size data for the randomly selected sample.

## **Coding Procedure**

Each study was coded for sample characteristics and performance outcomes. Each study provided: the year of the study, the names of the authors, and the country where the study was implemented. According to the inclusion criteria, study participants were students with reading difficulties. Other attributes that were coded included: the number of participants in each subgroup, the number of males and females in each subgroup, the grade level of each subgroup, and ethnicity.

In addition to the sample characteristics, performance outcome data from the following categories were coded:

1. *Phonological awareness*: This category refers to knowledge of letter sounds. It was measured using the Comprehensive Test of Phonological Processing

(CTOPP), the Test of Phonological Awareness (TOPA), Test of Preschool Early literacy (TOPEL) – Phonological Awareness subtest, and the Phonological Awareness Literacy Screening for Kindergarten (PALS-K) Letter Sounds subtest.

2. *Alphabetics*: This category refers to the skills involved with accurately identifying and naming letters. It was measured using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Letter Naming Fluency subtest, Test of Preschool Early literacy (TOPEL) – Print Awareness subtest, and the Phonological Awareness Literacy Screening for Kindergarten (PALS-K) Letter Knowledge subtest.
3. *Decoding*: This category refers to applying Phonological Awareness and Alphabetics to read new words. It was measured using the Woodcock Reading Mastery Tests (WRMT; or the Woodcock-Johnson Tests of Achievement) Word Attack subtest, and the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Nonsense Word Fluency subtest.
4. *Word Reading*: This category refers the skills involved with fluently reading words. It was measured using the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Oral Reading Fluency subtest, and the Woodcock Reading Mastery Tests (WRMT; or the Woodcock-Johnson Tests of Achievement) Word Identification subtest.
5. *Spelling*: This category refers to the skills involved with correctly spelling words. It was measured using the Wide Range Achievement Test (WRAT) – Revised Spelling Subtest, and the Phonological Awareness Literacy Screening for Kindergarten (PALS-K) Spelling subtest.

6. *Reading Comprehension*: This category refers to the skills involved with reading and understanding a text. It was measured using the Woodcock Reading Mastery Tests (WRMT; or the Woodcock-Johnson Tests of Achievement) Passage Comprehension subtest, the Gates-MacGinitie Reading Test (GMRT), and the Gray Oral Reading Tests (GORT) Comprehension subtest.

### **Calculation of Effect Size**

For all studies, the Hedges (1981) procedure for calculating unbiased estimates of Cohen's  $d$  was used (this statistic is also known as Hedges's  $g$ ). The procedure was chosen for two reasons. First, the aim of this study is to compare mean differences across paraeducator-implemented intervention outcomes. Second, since the scale of measurement may not be comparable across all of the included studies, a standardized mean difference is required. Hedges's  $g$  was calculated by using the means and standard deviations for treatment and comparison groups when such data were provided. In some cases, Cohen's  $d$  was reported and means and standard deviations were not available. To interpret effect sizes, Cohen's (1988) criteria were used. Effects less than 0.20 are considered small. Effects between 0.20 and 0.80 are considered medium. Effects above 0.80 are considered large. The following formula was specifically used to calculate Effect Size:

$$ES = \frac{(X_1 - X_{1\ pre}) - (X_2 - X_{2\ pre})}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 + n_2 - 2)}}$$

## Random-Effects Model

The current meta-analysis attempted to employ a random-effects model in order to account for the variability of treatment effects and the variability attributed to the sample of the population. The random-effects model is represented by the following equation:

$$y_i = \beta_R + u_i + e_i$$

A Cochran's Q test for homogeneity of variance (Cooper, 1998) was also conducted in order to determine whether the observed data are practically significant with the following equation:

$$Q = \sum (w \times ES^2) - \frac{(\sum w_{sm} \times ES_{sm})^2}{\sum w_{sm}}$$

If the resulting  $Q$ -value does not exceed the .05 critical value relative to the degrees of freedom of the sample size, then the assumption of homogeneity of variance can be satisfied, meaning that the variance of the current sample of effect sizes is not significantly greater than is expected from sampling error alone. Although Cochran's Q is a useful method of testing for heterogeneity, the statistic overestimates the level of heterogeneity between studies (Higgins & Thompson, 2002). In order to give a more appropriate idea of the impact of heterogeneity existing between studies, Higgins and Thompson developed the  $I^2$  statistic to gauge the impact of heterogeneity. Scores above 0.50 are considered to be highly impacted by heterogeneity. The following equation was used to calculate the  $I^2$  statistic:

$$I^2 = \frac{Q - df}{Q}$$

## Results

The participant demographics can be seen in Table 1.1. Across all nine studies there were a total of 747 participants (N = 747). Grades ranged from preschool to second. Of the total number of participants, 44% were assigned to groups where intervention was solely administered by paraeducators. The other 56% participated in non-treatment control groups. Erhi, Dreyer, Flugman, and Gross (2007) also included a group where intervention was solely administered by teachers. Although this group was not included in the current analysis, some of the demographic numbers were affected. Males accounted for 62% of the participants while 38% of participants were female. Seven of the studies provided information regarding their participants' ethnicity. Two studies (Vadasy, Sanders, & Peyton, 2006; Nelson, Sanders, & Gonzalez 2009) categorized participants as "Minorities" without further breaking down their ethnicities. Of the reported ethnicities, approximately 28% of participants were White, and 72% of participants were members of a minority ethnic group.

*Table 1.1*  
**Participant Characteristics by Study**

	Vadasy et al., 2006 (n = 67)	Ehri et al., 2007 (n = 96)	Lane et al., 2007 (n = 24)	Vadasy et al., 2007 (n = 43)	Nelson et al., 2009 (n = 88)	Vadasy & Sanders, 2009 (n = 148)	Bingha m et al., 2010** (n = 63)	Vadasy & Sanders, 2010 (n = 148)	Yurick et al., 2012 (n = 70)	Total (N=74 7)
Grade	Kinder	1	1	2	Pre	2	Kinder	Kinder	Kinder	-
Treatment	36	26	13	23	41	44	38	67	38	326
Control	31	70	11	20	47	104	25	81	32	421
Gender										
Male	39	94*	18	21	46	85	36	82	45	466
Female	28	90*	6	22	42	63	27	66	25	369
White	9	-	12	17	21	49	53	21	25	207
Minority	58	-	12	26	67	99	9	127	45	443
Asian	-	-	-	7	-	16	0	30	1	54
Black	-	-	3	15	-	31	0	34	36	119
Hispanic	-	-	9	0	-	41	9	59	5	123
Other/Mi xed	-	-	-	4	-	11	0	4	3	22

\* *Ehri et al. (2007)* also contained a third, teacher-only group. Although this teacher-only group was not used in the analysis, gender numbers are affected. \*\* *Bingham et al. (2010)* does not explain the discrepancy in the white and minority totals

Each study was coded for outcome means and standard deviations at pretest and at posttest across each of the six categories (see Table 1.2). These data were used to calculate effect sizes (see Table 1.3) which yielded 26 in all. Mean effect sizes for each study ranged from -0.07 (Vadasy & Sanders, 2009) to 1.14 (Bingham, Hall-Kenyon, & Culatta, 2010). The overall effect size across all nine studies was 0.55, falling into the moderate range (95% CI: 0.28 – 0.81). Table 1.4 shows overall effect sizes moderated by outcome variables. Five of the outcomes produced moderate effects with reading comprehension at the lower end of the range (ES = 0.42) and decoding at the upper end (ES = 0.61). Spelling was the only outcome to produce an effect in the high range with an effect of 0.86 (95% CI: 0.23 – 1.49). Additionally, only two outcomes produced effects that met the assumption of homogeneity of variance: decoding ( $Q = 2.83, I^2 = -0.06$ ) and spelling ( $Q = 5.99, I^2 = 0.50$ ). The high  $I^2$  values associated with all of the other outcomes suggest that much of the variability in the treatment effects are due to real differences in the population sample across the included studies. This finding indicates a need to further examine effect sizes before interpreting them.



*Table 1.2*  
**Means and Standard Deviations of Outcome Variables**

	Phonological Awareness	Alphabetics	Decoding	Word Reading	Spelling	Reading Comprehension
	<i>Pre/Post</i>	<i>Pre/Post</i>	<i>Pre/Post</i>	<i>Pre/Post</i>	<i>Pre/Post</i>	<i>Pre/Post</i>
Vadasy et al., 2006						
Treatment	83(8.6)/ 88(11.9)	6(5.6)/ 21(14.2)	90(1.4)/ 98(9.5)	-	28(26.3)	89(7.4)
Control	83(8)/ 85(10.2)	4(5.3)/ 20(10.4)	90(1.3)/ 90(6.9)	-	14(21.6)	87(6.8)
Ehri et al., 2007						
Treatment	-	-	-	-	-	46.5(11)
Control	-	-	-	-	-	38.7(10.9)
Lane et al., 2007						
Treatment	72.17(10.67)/ 84.63(12.33)	-	21.21(19.0 9)/ 59.06(28.6 6)	-	-	-
Control	73.64(10.58)/ 76.4(8.5)	-	23.54(26.2 6)/ 48.88(21.6 5)	-	-	-
Vadasy et al., 2007						
Treatment	-	-	89(5.76)/ 96.6(5.82)	26.3(14.05)/ 52(21.24)	7.9(3.26)/ 12.6(3.98)	-
Control	-	-	89.6(3.88)/ 93.9(5.52)	26.8(13.7)/ 41.1(19.86)	9(3.98)/ 11.7(3.61)	-
Nelson et al., 2009						
Treatment	11.46(5.31)/ 15(6.28)	5.9(6.86)/ 12.4(8.81)	-	-	-	-
Control	10.6(6.3)/ 13.38(6.23)	6.8(7.93)/ 9.9(9.26)	-	-	-	-
Vadasy & Sanders, 2009						
Treatment	-	23.57(2.28)/ 24.45(2.02)	-	96.89(8.34)/ 97.7(6.32)	-	88.75(12.9)/ 94.89(16.51)
Control	-	23.64(2.75)/ 24.45(1.76)	-	96.75(8.71)/ 98.66(9.24)	-	84.57(11.72)/ 92.21(14.6)
Bingham et al., 2010						
Treatment	7.73(5.74)/ 18.89(4.64)	12.27(6.64)/ 22.68(3.81)	-	-	0.73(2.5)/ 13.22(5.15 )	-
Control	13.42(7.45)/ 18.88(6.26)	16.04(6.83)/ 20.68(6.52)	-	-	7.96(5.94)/ 12.44(6.12 )	-
Vadasy & Sanders, 2010						
Treatment	89.17(9.72)/ 98.21(13.22)	14.76(7.94)/ 48.51(14.13)	-	93.62(7.1)/ 112.47(9.75 )	8.34(14.63 ) 77.72(34.6 8)	103(10.43)
Control	86.11(7.47)/ 92.6(10.37)	14.38(13.52)/ 35.8(17.33)	-	93.1(4.97)/ 102.84(11.2 5)	8.29(10.66 ) 44.89(34.9)	95.2(9.73)

				)	
Yurick et al., 2012					
Treatment	-	-	2.1(0.96)/ 5.8(1.6)	9.6(4.2)/ 19.5(3.5)	-
Control	-	-	3.2(1.4)/ 6.2(1.9)	13.9(5.2)/ 21.3(4.8)	-

---

*Some outcomes were post-test only.*

*Table 1.3*  
**Study Effect Sizes by Outcomes**

	PA	Alphabetics	Decoding	Word Reading	Spelling	Reading Comp	Overall
Vadasy et al., 2006	0.27	-0.08	0.98	-	0.59	0.28	0.47
Ehri et al., 2007	-	-	-	-	-	0.71	0.71
Lane et al., 2007	0.93	-	0.56	-	-	-	0.75
Vadasy et al., 2007	-	-	0.58	0.56	0.53	-	0.56
Nelson et al., 2009	0.12	0.38	-	-	-	-	0.25
Vadasy & Sanders, 2009	-	0.04	-	-0.15	-	-0.09	-0.07
Bingham et al., 2010	1.00	1.03	-	-	1.40	-	1.14
Vadasy & Sanders, 2010	0.21	0.79	-	0.87	0.94	0.77	0.72
Yurick et al., 2012	-	-	0.4	0.6	-	-	0.50

*Table 1.4*  
**Mean Effect Sizes**

	K	Mean ES	SD	95% CI	Q	I <sup>2</sup>
Overall	26	0.55	0.34	0.28 – 0.81	*19.55	0.59
PA	5	0.51	0.42	-0.02 – 1.03	*9.50	0.58
Alphabetics	5	0.43	0.48	-0.16 – 1.02	**18.33	0.78
Decoding	4	0.61	0.25	0.21 - 1.02	2.83	-0.06
Word Reading	4	0.46	0.43	-0.23 – 1.16	**17.5	0.83
Spelling	4	0.86	0.40	0.23 – 1.49	5.99	0.50
Reading Comp	4	0.42	0.40	-0.23 – 1.06	**14.19	0.79

*\* Indicates significance at the 0.05 level. \*\* Indicates significance at the 0.01 level.*

Three patterns seem to emerge when effect sizes are moderated by other variables. First when effects are examined by grade level (see Table 1.5), there is a steady increase beginning in preschool (ES = 0.25) and extending into First grade (ES = 0.71). In second grade there is a sharp drop (ES = 0.24). This pattern is consistent across outcomes with the exception of decoding, which dips in first grade (ES = 0.50) and rises in second grade (ES = 0.58). The second pattern emerges when effects are examined by ethnic ratio (see Table 1.6). Ethnic ratio is defined as the number of minority student over the total number of students. Overall, when the ethnic ratio is low, the effect is high (ES =

0.93). In the medium ratio the effect drops (ES = 0.39) and then rises to a moderate level when the ratio is high (ES = 0.56). The pattern is also consistent across outcomes with the exception of phonological awareness which seems to have an inverse relation to ethnic ratio. The final pattern is observed when effect sizes are moderated by gender ratio (see Table 1.7). Gender ratio is defined as the number of male participants over the total number of participants. The effects by gender ratio are not as consistent across outcomes as they are in other moderators, but when overall effects are observed, the effect size increases as the number of male participants increase.

*Table 1.5*  
**Effect Sizes and Standard Deviations by Grade Level**

	Pre	Kinder	1st	2nd
Overall	0.25(NA)	0.69(0.33)	0.71(0.002)	0.24(0.44)
PA	0.12(NA)	0.50(0.44)	0.93(NA)	-
Alphabetics	0.38(NA)	0.58(0.58)	-	0.04(NA)
Decoding	-	0.69(0.41)	0.50(NA)	0.58(NA)
Word Reading	-	0.73(0.20)	-	0.20(0.50)
Spelling	-	0.97(0.40)	-	0.53(NA)
Reading Comp	-	0.53(0.35)	0.71(NA)	-0.09(NA)

*Standard Deviations marked "NA" reflect a single effect size for that category.*

*Table 1.6*  
**Effect Sizes and Standard Deviations by Ethnic Ratio**

	Low	Medium	High
Overall	0.93(0.30)	0.39(0.31)	0.56(0.22)
PA	1.00(NA)	0.53(0.57)	0.24(0.04)
Alphabetics	1.03(NA)	0.21(0.24)	0.35(0.61)
Decoding	-	0.49(0.09)	0.98(NA)
Word Reading	-	0.33(0.42)	0.87(NA)
Spelling	1.39(NA)	0.53(NA)	0.76(0.25)
Reading Comp	0.71(NA)	-0.09(NA)	0.53(0.35)

*Ethnic Ratio is defined as the ratio of minority participants over the total number of participants. Low =  $x < 0.20$ , Medium =  $0.20 < x < 0.80$ , High =  $x > 0.80$ . Standard Deviations marked "NA" reflect a single effect size for that category.*

*Table 1.7*  
**Effect Sizes and Standard Deviations by Gender Ratio**

	0.48 - 0.60	0.60 - 0.70	0.70 - 0.80	> 0.90
Overall	0.50(0.41)	0.49(NA)	0.71(NA)	0.71(NA)
PA	0.40(0.40)	-	0.93(NA)	-
Alphabetics	0.43(0.48)	-	-	-
Decoding	0.78(0.28)	0.40(NA)	0.50(NA)	-
Word Reading	0.43(0.52)	0.59(NA)	-	-
Spelling	0.86(0.40)	-	-	-
Reading Comp	0.32(0.43)	-	-	0.71(NA)

*Gender Ratio is defined as the ratio of male participants over the total number of participants. Standard Deviations marked “NA” reflect a single effect size for that category.*

## **Discussion**

### **Overall Effectiveness**

The purpose of the current study is to use meta-analytic procedure to aggregate data across multiple studies of paraeducator-implemented reading interventions in order to make inferences about their effectiveness. The first research question regarded the overall effectiveness of paraeducator-implemented reading interventions. Although the mean overall effect size ( $ES = 0.55$ ) was fairly large when placed in the context of other meta-analytic studies of reading interventions (Wanzek & Vaughn, 2007; Wanzek et al., 2013), this result must be interpreted with caution for two reasons. The first reason involves the limited amount of studies that met the inclusion criteria. It is possible that since a small number of studies was included in the current meta-analysis, the mean overall effect size may be inflated. This inflation effect may also have affected the effect sizes associated with the other outcome variables. The second reason involves the high  $I^2$  value associated with the mean overall effect size ( $I^2 = 0.59$ ). This high value indicates a significant heterogeneity among the studies included in the current meta-analysis. A possible explanation for this might be that the participants and treatments involved in each respective study were too different to be compared. This result prevents the overall mean effect size from being interpreted at face value. In order to find practical meaning in the results, moderator variables must be explored.

### **Most Effective Areas**

The second research question asked in which areas of reading intervention are paraeducators most effective? The areas of decoding ( $ES=0.61$ ;  $Q=2.38$ ;  $I^2 = -0.06$ ) and



spelling (ES=0.86; Q=5.99; I<sup>2</sup>=0.50) seem to be where paraeducators are most effective as these are the only outcomes that met the assumption of homogeneity of variance. As is the case with the overall mean effect, these outcome effect sizes must be interpreted with caution due to issues associated with inflation. Although the results of this meta-analysis may not have immediate implications for practice, the findings indicate that future research should assess outcomes associated with paraeducator implementation of evidence-based interventions that provide direct explicit instruction in the areas of decoding and spelling.

**Emerging patterns.** When outcome effects were further moderated by grade level, ethnicity, and gender, three interesting patterns emerged. As previously mentioned, these patterns do not have explanatory power on their own, nor do they have immediate implications for practice. Rather, these patterns provide insight to the state of this area of research and a vision for where it can go in the future.

**Grade level.** The first pattern that was observed occurred when the outcome effects were moderated by grade level. There is an overall trend of growing improvement starting in preschool and peaking in first grade. In second grade, effect sizes drop across outcomes. This pattern could lead to two questions that future research may be able to answer. First, would this trend continue beyond second grade? There were no studies that met inclusion criteria for the current meta-analysis that implemented intervention to students beyond second grade. Future research that focuses on paraeducator-implemented interventions for older grades may provide more insight. The second question that could be answered by future research is: if this pattern can be replicated, is there an indication

of second grade stagnation? Since post-test scores were collected toward the end of the school year in each study, the drop-off may be indicative of the so-called “third grade slump” (Caldwell, 1987), in which the focus of the instruction shifts from constrained aspects of reading (phonological awareness and alphabets) to unconstrained aspects such as vocabulary and comprehension. Students who do not achieve proficiency in the constrained aspects by the time this shift occurs struggle. Wanzek et al. (2013) also documented a drop off of intervention effects occurring after the primary grades. Perhaps these findings, in conjunction with those of the current study, are indicative of the Matthew effect (Stanovich, 1986) where an achievement gap is formed between those who achieve this proficiency and those that do not. Conceivably, future research can investigate this phenomenon.

***Ethnic ratio.*** The second pattern is observed when outcome effects are moderated by ethnic ratio. This ratio is defined as the proportion of ethnic minority students to the total number of students. Effects are highest both when the ratio is low and when it is high. This finding suggests two questions that can be answered by future research. First, how effective are paraeducator-implemented reading interventions for minority students? Only two of the included studies (Ehri, Dreyer, Flugman, & Gross, 2007; Vadasy, & Sanders, 2010) explicitly targeted minority students. Additionally, some of the included studies treated minority students as a homogeneous group. A second question that can be addressed by future research involves paraeducators and their cultural and linguistic connections to the communities in which they live. According to Darling-Hammond (1998) paraeducators are often bilingual and are fairly involved in the communities that

they work in. This assumption should be empirically evaluated through reading intervention research.

***Gender ratio.*** The third pattern emerges when effects are moderated by gender ratio. Gender ratio is defined in this study as the proportion of male students to the total number of students. As the number of males grow, outcome effects increase. This finding points out two avenues for future research. First, future research should strive to include more female students in paraeducator-implemented reading intervention studies. As previously noted, 62% of participants across all nine included studies were male. Such a disproportionate result makes it difficult to generalize findings. The second way this finding can inform future research is to investigate how a possible over identification of male students with reading difficulties (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990) impacts reading intervention outcomes.

### **Limitations**

Several limitations of the current study should be noted to frame the interpretation of the results and inform future research. The first limitation involves the heterogeneity of the included studies and a possible inflation of the effect sizes. Cochran's Q test (Cooper, 1998) indicated that the overall mean effect and many of the outcome effects did not meet the assumption of homogeneity of variance. High  $I^2$  values suggest that much of the variability in the treatment effects are due to real differences in the population sample across the included studies. Although this may indicate a need to further moderate the effects, interpretations are still limited by the low number of studies that met inclusion criteria, which may have inflated effect sizes. The second limitation involves the studies

that met inclusion criteria. Many of the included studies were conducted by the same research team which utilized similar methods and population samples across their studies. It is possible that inclusion of such studies may have affected the generalizability of the meta-analytic findings. Additionally, all of the studies were conducted in settings with researcher training and support, which also limits the practical implications of the current meta-analysis. The third limitation regards the effects moderated by gender ratio. The results may have been influenced by an uneven proportion of male to female participants. All of the limitations mentioned could possibly be mitigated if the literature base associated with paraeducator-implemented reading interventions was extended in the future.

## **Conclusion**

At the outset of this study, the intention was for the findings to provide meaningful implications to inform practice, but due to limitations involving homogeneity of the variance and a possible inflation of effect sizes, the results had to be interpreted with caution. That being said, the results of the current meta-analysis can provide a preliminary direction for future research. Possibly the most promising findings indicate a need to further investigate paraeducator-implemented reading interventions that target decoding and spelling skills. Should evidence support this practice, paraeducator-implemented reading interventions may provide supplemental support that remedies problems with intervention implementation. Other patterns that emerge from the results involving grade level, ethnic minority, and gender effects that highlight other gaps in the literature. All of the findings point to what might be the current study's most significant

take away; the research base surrounding paraeducator-implemented reading interventions needs to be expanded. Perhaps once the literature becomes more robust, another meta-analysis can be conducted to provide meaningful implications for practice.

## References

- \*Bingham, G., Hall-Kenyon, K., & Culatta, B. (2010). Systematic and Engaging Early Literacy: Examining the Effects of Paraeducator Implemented Early Literacy Instruction. *Communication Disorders Quarterly*, 32(1), 38–49. <https://doi.org/10.1177/1525740109340796>
- Brown, K., Morris, D., & Fields, M. (2005). Intervention After Grade 1: Serving Increased Numbers of Struggling Readers Effectively. *Journal of Literacy Research*, 37(1), 61–94.
- Caldwell, B. (1987). Staying Ahead: The Challenge of Third-Grade Slump. Special Report: Early Childhood Education. *Principle*, 66(5), 10–14.
- Causton-Theoharis, J., Giangreco, M., Doyle, M., & Vadasy, P. (2007). Paraprofessionals: The “Sou-Chefs” of Literacy Instruction. *TEACHING Exceptional Children*, 40(1), 56–62.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.).
- Cooper, H. (1998). *Synthesizing research: A guide for literature reviews*. Thousand Oaks, CA: Sage Publications.
- Darling-Hammond, L. (1998). How can we ensure a caring, competent, qualified teacher for every child. In *National Commission on Teaching & America’s Future. Paper presented at the American Federation of Teachers/National Education Association Joint Conference, Washington, DC. Retrieved October* (Vol. 22, p. 2008).
- \*Ehri, L., Dreyer, L., Flugman, B., & Gross, A. (2007). Reading Rescue: An Effective Tutoring Intervention Model for Language-Minority Students Who Are Struggling Readers in First Grade. *American Educational Research Journal*, 44(2), 414–448. <https://doi.org/10.3102/0002831207302175>
- Foorman, B., Francis, D., Fletcher, J., Schatschneider, C., & Mehta, P. (1998). The Role of Instruction in Learning to Read: Preventing Reading Failure in At-Risk Children. *Journal of Educational Psychology*, 90(1), 37–55.
- Hedges, L. (1981). Distribution theory for Glass’s Estimator of effect size and related estimators. *Journal of Educational Statistics*, 6(2), 107–128.
- Higgins, J., & Thompson, S. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine*, (21), 1539–1558. <https://doi.org/10.1002/sim.1186>

- Jenkins, J., Fuchs, L., Van der Broek, P., Espin, C., & Deno, S. (2003). Sources of Individual Differences in Reading Comprehension and Reading Fluency. *Journal of Educational Psychology, 95*(4), 719–729. <https://doi.org/10.1037/0022-0663.95.4.719>
- Juel, C. (1988). Learning to Read and Write: A Longitudinal Study of 54 Children From First Through Fourth Grades. *Journal of Educational Psychology, 80*(4), 437–447.
- Kamps, D., Abbott, M., Greenwood, C., Arreaga-Mayer, C., Wills, H., Longstaff, J., ... Walton, C. (2007). Use of Evidence-Based, Small-Group Reading Instruction for English Language Learners in Elementary Grades: Secondary-Tier Intervention. *Learning Disability Quarterly, 30*, 153–168.
- \*Lane, K., Fletcher, T., Carter, E., Dejud, C., & DeLorenzo, J. (2007). Paraprofessional-Led Phonological Awareness Training With Youngsters at Risk for Reading and Behavioral Concerns. *Remedial and Special Education, 28*(5), 266–276.
- Lyon, G., Fletcher, J., Shaywitz, S., Shaywitz, B., Torgesen, J., Wood, F., ... Olson, R. (2001). Rethinking Learning Disabilities. In *Rethinking special education for a new century* (pp. 259–287).
- National Reading Panel (US), & National Institute of Child Health, & Human Development (US). (2000). Report of the national reading panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups. *National Institute of Child Health and Human Development, National Institutes of Health*.
- \*Nelson, J., Sanders, E., & Gonzalez, J. (2009). The Efficacy of Supplemental Early Literacy Instruction by Community-Based Tutors for Preschoolers Enrolled in Head Start. *Journal of Research on Educational Effectiveness, 3*(1), 1–25. <https://doi.org/10.1080/19345740903381031>
- O'Connor, R. (2000). Increasing the Intensity of Intervention in Kindergarten and First Grade. *Learning Disabilities Research & Practice, 15*(1), 43–54.
- Perfetti, C. (1985). *Reading Ability*. Oxford University Press.
- Scruggs, T., & Mastropieri, M. (1996). Teacher Perceptions of Mainstreaming/Inclusion, 1958 - 1995: A Research Synthesis. *Exceptional Children, 63*(1), 59–74.
- Stanovich, K. (1986). Matthew Effects in Reading: Some Consequences of Individual Differences in the Acquisition of Literacy. *Reading Research Quarterly, 21*(4), 360–407.

- Shaywitz, S., Shaywitz, D., Fletcher, J., & Escobar, M. (1990). Prevalence of Reading Disability in Boys and Girls: Results of the Connecticut Longitudinal Study. *Journal of the American Medical Association*, 264(8), 998–1002.
- Title I Paraprofessionals: Non-regulatory Guidance*. (2004). Washington D.C.: U.S. Department of Education.
- Torgesen, J., Wagner, R., Rashotte, C., Rose, E., Lindamood, P., & Conway, T. (1999). Preventing Reading Failure in Young Children with Phonological Processing Disabilities: Group and Individual Responses to Instruction. *Journal of Educational Psychology*, 91(4), 579–593.
- \*Vadasy, P., & Sanders, E. (2008). Repeated Reading Intervention: Outcomes and Interactions With Readers' Skills and Classroom Instruction. *Journal of Educational Psychology*, 100(2), 272–290. <https://doi.org/10.1037/0022-0663.100.2.272>
- \*Vadasy, P., & Sanders, E. (2009). Supplemental Fluency Intervention and Determinants of Reading Outcomes. *Scientific Studies of Reading*, 13(5), 383–425. <https://doi.org/10.1080/10888430903162894>
- \*Vadasy, P., & Sanders, E. (2010). Efficacy of Supplemental Phonics-Based Instruction for Low-Skilled Kindergarteners in the Context of Language Minority Status and Classroom Phonics Instruction. *Journal of Educational Psychology*, 102(4), 786–803. <https://doi.org/10.1037/a0019639>
- \*Vadasy, P., Sanders, E., & Peyton, J. (2006). Code-Oriented Instruction for Kindergarten Students At Risk for Reading Difficulties: A Randomized Field Trial With Paraeducator Implementers. *Journal of Educational Psychology*, 98(3), 508–528. <https://doi.org/10.1037/0022-0663.98.3.508>
- \*Vadasy, P., Sanders, E., & Tudor, S. (2007). Effectiveness of Paraeducator- Supplemented Individual Instruction: Beyond Basic Decoding Skills. *JOURNAL OF LEARNING DISABILITIES*, 40(6), 508–525.
- Wanzek, J., & Vaughn, S. (2007). Research Based Implications From Extensive Early Reading Interventions. *School Psychology Review*, 36(4), 541–561.
- Wanzek, J., & Vaughn, S. (2008). Response to Varying Amounts of Time in Reading Intervention for Students With Low Response to Intervention. *Journal of Learning Disabilities*, 41(2), 126–142. <https://doi.org/10.1177/0022219407313426>
- Wanzek, J., Vaughn, S., Scammacca, N., Metz, K., Murray, C., Roberts, G., & Danielson, L. (2013). Extensive Reading Interventions for Students With Reading Difficulties After



Grade 3. *Review of Educational Research*, 83(2), 163–195.  
<https://doi.org/10.3102/0034654313477212>

\*Yurick, A., Cartledge, G., Kourea, L., & Keyes, S. (2012). Reducing Reading Failure for Kindergarten Urban Students: A Study of Early Literacy Instruction, Treatment Quality, and Treatment Duration. *Remedial and Special Education*, 33(2), 89–102.  
<https://doi.org/10.1177/0741932510365359>