FEATURES OF EFFECTIVE INTERVENTIONS FOR NON-RESPONDERS—

A SYNTHESIS OF THE RESEARCH

by

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The present synthesis is an extension of Wanzek and Vaughn on early reading interventions for students who did not respond to initial intervention and are at risk for reading difficulties and disabilities. Five studies published between 2005 and 2007 are examined on features of the intervention. Some findings aligned with those of Wanzek and Vaughn, such as duration of interventions did not impact outcomes and earlier intervention starting from kindergarten had larger impact across measures. Other findings differed from the previous findings, such as group size was not a determining factor. Furthermore, there are other features discussed in the present research that were not identified in the previous synthesis, such as role of implementers. Further research suggestions and limitations are also discussed in the present synthesis.

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To my beloved father, mother and husband.

TABLE OF CONTENTS

Chapter Page

CHAPTER I

INTRODUCTION

Response to Intervention (RTI) has received increased attention in the research base since researchers and educational agencies considered IQ-achievement discrepancy a flawed approach for identifying students with learning disabilities (Fuchs & Fuchs, 2006; Fuchs, Mock, Morgan & Young, 2003). The earlier identification and more timely support to students with learning disabilities or difficulties, inherent in an RTI approach, make it a more effective alternative over the IQ-achievement discrepancy approach (National Research Center on Learning Disabilities [NRCLD], 2005). Siegel (2003) has urged practitioners and researchers to abandon the IQ-achievement discrepancy model and focus on early identification, early intervention, and remediation instead.

Features of RTI go beyond early identification of students with learning disabilities or difficulties and timely support. According to Fuchs et al. (2003), RTI involves the classroom teacher providing effective instruction to all students, progress monitoring, providing support to students who do not respond to universal instruction, and providing extra support and special education evaluation to students who do not respond to secondary intervention. The National Association of State Directors of Special Education (NASDSE, 2006) defined RTI as "… the practice of (1) providing high-quality instruction/ intervention matched to students' needs and (2) using learning rate over time and level of performance to (3) make important educational decisions" (p. 5). Vaughn,

Wanzek, Woodruff, and Linan-Thompson (2007) further illustrated a clear three-tier RTI model and described the features in each tier. Tier 1 is the core curriculum for all students, Tier 2 is increased instructional supports in small groups in addition to Tier 1, and Tier 3 is customized instruction for students who are not responding to both Tiers 1 and 2.

Many have found that using RTI decreases the number of students with learning disabilities and increases reading skills. However, a common finding across reading research is that 2-6 % of students do not respond to intervention, and are called treatment resisters (Torgesen, 2000). Students who do not respond to Tier 2 treatments are often described as being "at the top of the triangle" (Tier 3) and in need of intensive support and resources. Common characteristics for students who do not respond are difficulties in phonological awareness, vocabulary, rapid naming, and behavioral problems (Al Otaiba & Fuchs, 2002; 2006).

Providing explicit evidence-based instruction is fundamental to early literacy instruction. Instruction and intervention in phonological awareness, decoding, fluency and comprehension are essential to young readers, especially to those who are at-risk for reading difficulties (Snow, Burns, & Griffin, 1998). Wanzek and Vaughn (2007) identified 18 extensive early reading intervention studies published between 1995 and 2005 and found positive outcomes across all studies. Their conclusions about intensive intervention included two elements: duration and intervention group size. It is suggested that intervention duration reported from 5 to 30 months did not show significant differences in effect sizes. On the other hand, one-on-one instruction was considered to be more effective than small group instruction with groups of two to eight students. A better understanding of the features of instruction and instructional delivery that are most

related to improved outcomes for all students and accelerate learning for treatment resisters (i.e., "nonresponders") would strengthen implementation of RTI.

This study extends the work of Wanzek and Vaughn (2007) and examines studies conducted between 2005 and 2007 that focused on extensive early reading interventions. This project hopes to provide teachers and practitioners with information when they make decisions about what types of interventions should be implemented, including the amount of time needed for implementation, the intervention group size, and the persons who will provide interventions to students who are at-risk for reading difficulties or reading disabilities.

This synthesis intends to address the following research question: What are the relevant features of intervention that related to positive effect sizes for struggling beginning readers?

CHAPTER II

METHOD

Search Strategy

The search strategy was adopted from a previous synthesis by Wanzek and Vaughn (2007). The articles in the present synthesis were identified by examining the following key education journals from January 2005 to December 2007: *Exceptional Children, Journal of Educational Psychology, Journal of Learning Disabilities, Journal of Special Education, Learning Disabilities Research & Practice, Reading Research Quarterly, and School Psychology Review.* There were a total of five articles retrieved from these key educational journals that fit the selection criteria. The present synthesis utilized the selection criteria of Wanzek and Vaughn (2007) to compare the similarities and differences of the findings.

Selection Criteria

The selection criteria for the present synthesis were as follows:

(1) Studies came from seven key educational and peer-reviewed journals printed in English.

(2) The participants were kindergarten to third grade students with learning disabilities, reading difficulties, or identified risk in reading. If the studies included additional participants, they had to show specific results for students with learning disabilities or reading difficulties.

(3) The interventions focused on early literacy. Interventions were provided by the school, but not part of general curriculum for all students and were provided for more than 100 sessions or 20 weeks of daily instruction. Studies that did not explicitly state the duration, but provided more than 35 hours of total instructional time, were included.

(4) The dependent variables addressed reading outcomes.

Data Analysis

Using the above criteria, most of the studies from the original search were eliminated based on their topics and abstracts. The first search extracted twenty reading experiments that demonstrated a possible fit with the criteria. Given a closer look and discussion with the thesis committee, five articles strictly fit the criteria. They were: Denton, C. A., Fletcher, J. M., Anthony, J. L., and Francis, D. J. (2006); Gunn, B., Smolkowski, K., Biglan, A., Black, C., and Blair, J. (2005); Schwartz, R. M. (2005); Simmons, D. C., Kame'enui, E. J., Harn, B., Coyne, M. D., Stoolmiller, M., Santoro, L. E., Smith, S. B., Beck, C. T., and Kaufman, N. K. (2007); and Vadasy, P. F., Sanders, E. A., and Peyton, J. A. (2006).

Coding

A coding matrix was adapted from Wanzek & Vaughn (2007) to identify features of the studies. The data was collected from the selected articles based on their features. The elements were (1) participants: numbers of participants, grade, age, and identification criteria; (2) methodology: research design, intervention frequency, and duration; (3) intervention: intervention materials and the nature of intervention; (4) measures: batteries of measures; and (5) findings: effect sizes of treatment and control groups. All coding sheets were reviewed by thesis committee for consistency and accuracy.

Effect Size

Effect sizes were calculated based on the type of data reported in each study (pre/post test, content, and groups) and are presented in Table 2 of Appendix F. Denton et al. (2006) reported the effect sizes of intervention pretest and posttest for each measure. Therefore, the data were adopted directly from the study. For studies with treatment and control groups (Gunn et al., 2005 and Vadasy et al., 2006), the effect sizes of each measure were calculated using standard deviations of Cohen's *d*. For Simmons et al. (2007) and Schwartz (2005), the Cohen's *d* were calculated using a between subject *t*-test and the degrees of freedom. It is suggested that effect sizes (ES) of .20 indicate small effects, ES of .50 indicate moderate effects, and ES of .80 indicate large effects (Cohen, 1988).

CHAPTER III

RESULTS

Five studies, reported across three peer-reviewed journals, met the criteria of this synthesis. Three of these studies used treatment versus control group comparisons (Gunn et al., 2005; Schwartz, 2005; Vadasy et al., 2006). Denton et al. (2006) divided participants into two groups with one group's intervention implemented first and the other implemented later. Simmons, et al. (2007) administrated three conditions in order to examine the impact of different foci on intervention length and standardization of intervention. Four out of five studies randomly assigned students into groups (Gunn et al., 2005; Schwartz, 2005; Simmons, et al., 2007; Vadasy et al., 2006). All of the studies measured intervention effectiveness using standardized measures, suggesting that the reliability of the intervention outcomes and the results are generalizable across studies. The characteristics of each study including number of participants, participant selection criteria, and grade levels; and intervention features including intervention frequency, duration, group size, implementer, and intensity, are presented in Table 1 (see Appendix F).

The results are summarized by the following features of the intervention: (1) duration, (2) group size, (3) implementer, and (4) instructional intensity. The following sections discuss these features accordingly.

Effects by Duration of Intervention

Less Than 20 Weeks

Two of the studies implemented interventions that were conducted for less than 20 weeks. However, the amount of instructional time devoted to each intervention was more than 35 hours. Therefore, the two studies were included. Effects on measures of early literacy skills varied. Denton et al. (2006) implemented Phono-Graphix and Read Naturally for students in grades 1-3 for 16 weeks. Vadasy et al. (2006) implemented 18 weeks of phonemic and alphabetic instruction for kindergarten students. The mean effect sizes of the two studies were .68 on word reading (range = -.18 to 1.77), .87 on fluency (range = .47 to 1.53), and .44 on comprehension (range = .19 to 1.00). The effect sizes of Vadasy et al. (2006) were .27 for phonological awareness and .08 for letter identification. No effect sizes were reported on phonological awareness or letter identification in the Denton et al. (2006) study.

More Than 20 Weeks

In the three remaining studies, the duration of intervention was at or exceeded 20 weeks. Gunn et al. (2005) used two direct instruction reading programs (Reading Mastery for 1^{st}- 2^{nd} grades and Corrective Reading for 3^{rd} - 4^{th} grades) for two years. Schwartz (2005) used Reading Recovery with two cohorts of 1^{st} grade for 20 weeks; one cohort was intervened with at the beginning of the school year and the other cohort was intervened with in the middle of the school year. Simmons et al. (2007) implemented the interventions for approximately 108 school days, which is approximately 22 weeks. The mean effect sizes across these studies were large. The mean effect size for phonological awareness was 1.13 (range = .49 to 2.37). A mean effect size of 1.52 was found for word

reading (range = .19 to 3.93), and 2.26 for letter identification (range = 1.84 to 2.99). The mean effect sizes were relatively small for fluency (.33; range = .18 to .47), and comprehension (.22; range = .05 to .52).

Effects by Intervention Group Size

One-on-one Instruction

Schwartz (2005) and Vadasy et al. (2006) implemented one-on-one interventions and yielded medium to large effect sizes. The mean effect sizes were .41 on phonological awareness (range = .27 to .62), 1.01 on word reading (range = .58 to 1.44), and .64 on fluency (range = .47 to .81). The effect sizes on letter identification and comprehension were only reported in Vadasy et al. (2006) with .08 on letter identification and .28 on comprehension.

Small Group Instruction

Three studies implemented instruction in small groups, with two to five students in each group. Denton et al. (2006) had two students in each group; Gunn et al. (2005) had two to three students in each group, whereas Simmons et al. (2007) had a range of two to five students in each group. The mean effect sizes were large, yielding 1.71 on phonological awareness (range = 1.10 to 2.37), 1.3 on word reading (range = -.18 to 3.93), and 2.26 on letter identification (range = 1.84 to 2.99). The mean effect sizes were relatively small for fluency (.55; range = .18 to 1.53), and comprehension (.35; range = .05 to 1.00) when compared to the effect sizes for other early reading skills examined.

Effects by Implementer

Implementers played an important role in delivering instruction. In two studies interventions were implemented by certified teachers (Denton et al., 2006; Schwartz,

2005), and two other studies used trained instructional assistants to implement interventions (Gunn et al., 2005 and Vadasy et al., 2006). Simmons et al. (2007) used four certified teachers and twenty-four instructional assistants as implementers. Therefore, the study was analyzed under the instructional assistants' category.

Certified Teachers

For the two studies implemented by certified teachers, mean effects were medium to large. Mean effect sizes were determined as follows: .55 on phonological awareness (range = .49 to .61), 1.11 on word reading (range = -.18 to 1.77), .70 on fluency (range = .47 to 1.53), and .60 on comprehension (range = .19 to 1.00).

Instructional Assistants

When examining the effect sizes of the three studies utilizing instructional assistants or paraprofessionals for intervention implementation, Simmons et al. (2007) and Vadasy et al. (2006) demonstrated large to medium effect sizes. The mean effect sizes of the three studies were .99 on phonological awareness (range = .27 to 2.37), 1.24 on word reading (range = .19 to 3.93), 1.21 on letter identification (range = .08 to 2.99), and .50 on fluency (range = .18 to 1.53). Comprehension measures revealed a smaller effect size of .24 (range = .05 to .52).

Effects by Instructional Intensity

Instructional intensity was classified into three categories: high, medium and low. Although the descriptors of intensity were not always provided explicitly in the studies, this synthesis classified the studies based on their description of the intervention and the intervention programs. Detailed descriptions of each intervention is listed in the Table 1. For the highly explicit interventions, the intervention included carefully sequenced skills

and materials with scripted wording for implementation and clear correction procedures. Medium explicit intervention represented well sequenced skills with general steps of implementation. Low explicit interventions were teacher developed programs to meet students' needs without carefully sequenced contexts. In the identified studies, no studies were classified in the low explicit intervention category.

Highly Explicit/ Systematic Intervention

Four studies had interventions classified as highly explicit interventions. The Phono-Graphix intervention in Denton et al. (2006) was classified as highly explicit and yielded a mean effect size of .79 (range = .44 to 1.77). Gunn et al. (2005) used Reading Mastery for 1st and 2nd grades and Corrective Reading for 3rd and 4th grades. The results revealed small to medium mean effect sizes of .24 (range = .18 to .49). Simmons et al. (2007) had three intervention groups; two of them (30H and 15H/15) reported using highly explicit intervention. The mean effect sizes for the highly explicit intervention groups were 2.07 (range = .50 to 3.82) and 1.72 (range = .05 to 2.35) respectively. Vadasy implemented a highly scripted program in phonemic and alphabetic skills and had a medium mean effect size of .50 (range = .08 to .95). Overall, the mean effect sizes were 1.52 on phonological awareness (range = .27 to 2.37), 1.86 on word reading (range = .19 to 3.93), 1.84 on letter identification (range = .08 to 2.99), .49 on fluency (range = .18 to .81), and .39 on comprehension (range = .05 to .67).

Medium Explicit/ Systematic Intervention

Three studies used interventions classified as medium explicit interventions. Denton et al. (2006) used Read Naturally as the second phase of the intervention. The mean effect size for Read Naturally on measures of early literacy was .32 (range = -.18 to .76).

Schwartz (2005) studied Reading Recovery in various states and yielded a mean effect size of .74 (range = .46 to 1.41). The mean effect size for the 30M group in Simmons et al. (2007) was 1.55 (range = .20 to 2.5). The mean effect sizes for all three studies were 1.15 on phonological awareness (range = .49 to 1.77), .70 on word reading (range = -.18 to 2.04), .62 on fluency (range = .47 to .76), and .21 on comprehension (range = .19 to .23). The letter identification measure was only reported in Simmons et al. (2007), with an effect size of 1.84.

CHAPTER IV

DISCUSSION

Being an extension of Wanzek and Vaughn (2007), the purpose of this project was to examine experimental studies from 2005 to 2007 that focused on intensive early reading interventions to identify the relevant features of interventions that had positive effects on students who did not respond to the core curriculum or previous intervention. It was hoped that the findings of this synthesis would facilitate decision-making in response to intervention (RTI) frameworks. The current synthesis adopted similar selection criteria from Wanzek and Vaughn (2007) and identified five journal articles that met the criteria. A detailed summary of each study is presented in Appendices A through E. Positive outcomes were found across all five studies for students with severe reading disabilities or difficulties when given extensive interventions on phonemic awareness, decoding, fluency, and comprehension.

Similarities of Current Findings to Wanzek and Vaughn (2007)

There are some similarities of the current findings to Wanzek and Vaughn (2007). In examining the duration of intervention, it did not appear to impact outcomes across all studies. In studies with interventions lasting less than 20 weeks (Denton et al., 2006 and Vadasy et al., 2006), results appeared as effective as studies that were implemented longer than 20 weeks. Although the duration of the studies ranged from 16 weeks to two years, the effect sizes were similar. It appears that 20 weeks of intervention is not an

absolute cutting point, as interventions implemented for slightly less than 20 weeks also demonstrate positive effects on student outcomes. Future studies may want to examine whether there is a threshold above and below which intervention duration does not insufficiently contribute to improvement in student reading skills. Also, it should be noted that the studies used moderate to highly explicit interventions. The explicitness of intervention intensity required to demonstrate positive student effects may have an impact on schools hoping to improve student reading skills.

Interventions beginning in kindergarten (Simmons et al., 2007 and Vadasy et al., 2006) had larger effect sizes across measures than interventions provided in 1st through 3rd grades. This finding is partially aligned with the suggestion of Wanzek and Vaughn (2007) that interventions beginning in first grade had a greater effect than interventions initiated in 2nd and 3rd grades. Although the findings of the current synthesis showed considerably larger effects for kindergarteners than were found for students in Wanzek and Vaughn (2007), it may be that kindergarten participants in the current synthesis had less pronounced difficulties than students in other grades.

Differences of Current Findings to Wanzek and Vaughn (2007)

The current synthesis also found several differences when compared to the previous synthesis. First, group size was not a determining factor of improvement. The one-on-one interventions were similarly beneficial to interventions implemented in groups of two to five students, consistent with other studies (e.g., Denton, et al., 2003). This finding contrasted with the findings of Wanzek and Vaughn (2007), who concluded that larger group sizes (two to eight students) had the lowest effects among studies. In addition, Vellutino et al. (1996) found that approximately 70% of first graders who were identified

in kindergarten with reading difficulties performed within average or higher on standardized tests after receiving at least one semester of one-on-one tutoring for 15 weeks or more. This finding implies that one-on-one tutoring is the best way to improve reading skills. The two slightly different grouping dimensions (one-on-one vs. small groups of two to five) may need more research to determine which one is more efficient and effective in improving reading skills of students with reading difficulties.

While not studied in Wanzek and Vaughn (2007), the current synthesis examined the role of implementers and found no significant differences. In the identified studies, outcomes were similar whether the implementers were certified teachers or paraprofessional assistants. However, it was suggested by Chard and Harn (in press) and Harn, Linan-Thompson, and Roberts, (2008) that explicitly scripted programs may be most critical for instructional assistants who work with the most at-risk students. Future studies are needed to examine in greater depth the role of instructional assistants as implementers.

Limitations

Because of the small sample of studies (a total of five studies), it is difficult to generalize findings. Additionally, meta-analytic methodology does not produce casual implications. The current synthesis set out to extend the findings of Wanzek and Vaughn (2007), only to find that in the extended time period between 2005 and 2007, the number of studies that met the criteria was small. However, the current synthesis was able to identify similarities with the previous synthesis by Wanzek and Vaughn (2007).

Another limitation was that there were few common measures and constructs (e.g., phonological awareness, comprehension, and vocabulary) employed across identified

studies in the current synthesis. Therefore, it is hard to generalize and compare the outcomes provided in the studies. Findings from the studies suggest that duration, group size and implementers are not decisive whereas explicitness of intervention is critical. However, findings of this synthesis should not be over-generalized to other situations such as after school or tutoring programs because those conditions or context may vary significantly from the controlled nature of the research studies reviewed in this synthesis.

Implications

The research articles discussed in this study suggest that length of intervention does not have a significant impact on student performance. However, it should be noted that all intervention examined in this study were greater than 16 weeks, thus it isn't clear whether shorter interventions will result in similar results. It's possible that a threshold may exist, after which the length of interventions is not a significant contributor to student outcomes.

Other relevant features of interventions that have positive effects for nonresponders are early intervention and small group size. Early supports in reading skills yielded better results in reading achievement. Although small group and one-on-one instruction did not yield significantly different results across measures and domains, it should be noted that small groups were comprised of two to five students in this study. This finding suggests that one-on-one instruction may not be necessary to improve students' reading skills and that groups of two to five students may be sufficient for implementing moderate to high intensity interventions. In addition, despite the insufficient number of studies in the synthesis, both highly and moderately intensive instruction appeared to be beneficial for students who did not make sufficient progress with previous interventions. This suggests

that students who have not made progress with initial interventions may make progress with more intensive interventions. In addition, for schools using RTI or three tier instructional supports, the findings suggest that schools and educators should begin early to identify students with reading difficulties and administer intervention.

The studies discussed in this project focused on tier 3 students, who were not responsive to initial intervention. If medium to high intensive interventions are delivered in a small group by either certified teachers or qualified instructional assistants for longer than 16 weeks, students are highly likely to make significant progress with the intervention. Additionally, interventions that are more explicit are more likely to have increased effects on student progress. These findings may support schools in identifying the variables to prioritize when structuring interventions for students.

Future Research

Further research should be conducted in the area of early reading instruction to examine the effectiveness of delivering instruction in medium or small size groups. It is important to identify how medium-sized groups, such as six to ten students in a group, might affect the effectiveness of reading instruction, when compared to smaller sized groups, such as two to five students. One variable that significantly impacts whether schools can vary group size is the resources and/or monies available. This synthesis found that student improvement was similar in one-on-one or small group settings, which is similar to the Wanzek and Vaughn (2007). Therefore, schools should take this into consideration when deciding how to allocate resources to balance budgetary issues as well as meeting the needs of individual students. Future studies should attempt to clarify how small these groups can be and still be effective (e.g., one to three, one to five, etc.)

based on the level of need for the students (e.g., extremely behind students may need smaller groupings to benefit than students that are not as far behind) to support schools in making more systematic and effective decisions.

Another issue revealed in the present study is the use of instructional assistants as implementers of interventions. Although the effect sizes do not show significant differences between types of implementers, additional research should examine the implementation outcomes concerning certified teachers or qualified instructional assistants as implementers.

Although not discussed in Wanzek and Vaughn (2007), nonresponder information (i.e., the definition and characteristics of nonresponders) is an essential area for learning disabilities research (Torgesen, 2000). In the current synthesis, only two out of five studies reported information on nonresponders. Furthermore, the definitions of nonresponders are inconsistent across the studies. It is recommended that the research community adopt a consistent definition of nonresponders and a consistent way to report the data on non-responders, in order to support the generalizability of results from studies.

Further research is also needed in the area of examining fluency-based measures versus accuracy-based measures. Of the studies included in the current synthesis, most did not administer fluency-based measures. However, Harn, Stoolmiller, and Chard (2008) suggest that fluency-based measures are more predictive of long-term reading proficiency than accuracy-based measures. Therefore, studies administering fluency-based measures have the potential to provide more valuable information regarding effective instruction

for students with significant reading difficulties or disabilities than accuracy-based measures, like those used in the studies examined in this synthesis.

CHAPTER V

CONCLUSION

As schools and districts gradually adopt RTI to respond to the needs of students with reading difficulties or disabilities, the content and features of interventions are a major focus. This synthesis attempted to extend the study of Wanzek and Vaughn (2007) to identify effective intervention features for students with reading difficulties or disabilities. The results from five studies between 2005 and 2007 suggest that duration of intensive intervention, group size, and implementer do not greatly impact outcomes. However, earlier interventions beginning in kindergarten demonstrate larger effects across measures than interventions implemented after kindergarten. It should also be noted that because of the small sample of studies used for this synthesis, it is difficult to generalize these findings. The studies discussed also imply that to support effective intervention in the third tier of an RTI model, schools should begin early to identify and implement intervention to students who are at-risk for reading difficulties or not responsive to initial intervention. The synthesis also identified areas for further research including more information of the effect of group size and type of implementer on student learning.

APPENDIX A

DENTON ET AL. (2006)

Denton, C. A., Fletcher, J. M., Anthony, J. L., & Francis, D. J. (2006). An evaluation of intensive intervention for students with persistent reading difficulties. *Journal of Learning Disabilities, 39,* 447-466.

The purpose of the study was to build a tertiary reading intervention for students who do not respond adequately to primary and secondary intervention provided in first grade. The study evaluated the effectiveness of an eight-week code instruction program followed by an eight-week oral reading fluency program.

Participants in the study were students in first to third grades (n = 27) from four schools in a large district in the southwestern region of United States. Participants were ethnically diverse, with half identified as African-American, one-fifth as Hispanic, and one-fifth as European-American. Half of the participants received primary and secondary intervention in a previous study (Mathes et al. 2005), and half of the participants were nominated by teachers. All of the students met the study criteria outlined by Denton et al. (2006) (scores below 30th percentile in WJ-III Basic Reading Skills). The intervention was implemented by six certified instructors: five teachers and one highly qualify reading tutor. The intervention had high intervention fidelity; the observed fidelity rates in administrating intervention ranged from 92% to 100%. The interrater agreement showed

100% agreement on all of the indicators except for 94% on the indicator for redirecting off-task behavior.

The intervention consisted of two components: decoding and fluency. Both components lasted eight weeks. The first intervention component was *Phono-Graphix*, delivered in two 50 minutes sessions daily, and the second intervention component was *Read Naturally*, delivered in a one hour session daily. One teacher instructed groups of two students across both components of the intervention. Students were assigned to one of two groups for intervention. Group one received the intervention immediately (n = 16), while group two began with eight weeks of the baseline condition (n = 11). Eight measures were used to assess early literacy skills across three dimensions, including:

1. Spelling and decoding:

   Woodcock-Johnson, Third Edition (WJ-III)--Spelling

   Woodcock-Johnson, Third Edition (WJ-III)--Word Attack

   Woodcock-Johnson, Third Edition (WJ-III)--Letter-Word Identification

2. Word, nonword and text reading fluency:

   Test of Word Reading Efficiency (TOWRE)--Sight Word Fluency

   Test of Word Reading Efficiency (TOWRE)--Phonemic Decoding Fluency

   Gray Oral Reading Test, Fourth Edition (GORT-4)--Fluency Subtest

3. Reading comprehension:

   Woodcock-Johnson, Third Edition (WJ-III)--Passage Comprehension Subtest

   Gray Oral Reading Test, Fourth Edition (GORT-4)--Comprehension Subtest

The results showed that in the Phono-Graphix phase, students performed significantly different across all measures and domains (in decoding, fluency, and comprehension). In

the Read Naturally phase, performances on word, nonword and text reading fluency and one of the comprehension measures (WJ-III passage comprehension) were significantly different across groups. With Phono-Graphix and Read Naturally combined as an intervention package, participants demonstrated significant growth on all measures.

When individual performances were analyzed, almost half of the participants performed above the 25th percentile on the WJ-III Basic Reading Cluster, especially participants who had received Tier 1 and Tier 2 interventions. The individual pre/post intervention performance between phase one and two intervention also indicates that reading fluency built on decoding fluency skills as students perform better on later measures of individual reading performance.

The findings of the study suggest that intensive interventions that emphasize decoding, fluency and comprehension have a significant impact on students who are not responding adequately to Tier 1 and Tier 2 interventions or have profound reading difficulties. In addition, the results demonstrated that intensive reading intervention with explicit, systematic phonics instruction and high student involvement may benefit students with persistent, severe reading difficulties.

APPENDIX B

GUNN ET AL. (2005)

Gunn, B., Smolkowski, K., Biglan, A., Black, C., & Blair, J. (2005). Fostering the development of reading skill through supplemental instruction: Results for Hispanic and non-Hispanic students. *The Journal of Special Education, 39,* 66-85.

This article reported on a two-year reading program for kindergarten to third grade students targeting the development of decoding skills and reading fluency. The purpose of the study was to examine the effects of supplemental intervention on the reading skills of at-risk students with diverse backgrounds when compared to a control condition.

In the study, the research team identified students who showed reading difficulties (bottom 5% on DIBELS in their grade level) and/or aggressive social behavior (95^{th} percentile on Aggression scale of the Teacher Rating Form (TRF) of the Child Behavior Checklist (CBCL). Based on the results of these assessments, 299 K-3 students met the criteria for and participated in this study. Half of the participants (53.2%) were from Spanish speaking families. The researchers controlled for participants' ethnicity and grades, and then randomly assigned them to intervention and control groups. The intervention consisted of three elements: supplemental reading instruction, parent training, and social behavior interventions. In the supplemental reading instruction element, students received a 50-minute pullout session during the regular school day in addition to

regular instruction provided to all students. The intervention material used for first and second grade participants was *Reading Mastery* and for third and fourth grade participants was *Corrective Reading*. Intervention periods were spent on instruction in phonics, instruction in word reading and spelling, and practice with repeated reading passages to build fluency and accuracy in reading connected text. The intervention was carried out by nine trained instructional assistants in groups of two or three. The implementation fidelity and interrater agreement rates were high.

The parent training provided in the study consisted of weekly parent group sessions, for a total of 12-16 sessions, using the *Incredible Years* parent training program. The average parent participation rate was 5.88 sessions. For social behavior interventions, schools had two choices: Contingencies for Learning Academic and Social Skills (CLASS) or Dina Dinosaur's Social Skills and Problem-Solving Curriculum. Both interventions were implemented after school for about 20 sessions.

There were five measures administered to assess participants' early reading skills. They were:

1. Woodcock-Johnson Revised Test of Achievement (WJ-R): Letter-Word ID
2. Woodcock-Johnson Revised Test of Achievement (WJ-R): Word Attack
3. Oral Reading Fluency: three grade level passages, using DIBELS procedure.
4. Woodcock-Johnson Revised Test of Achievement (WJ-R): Vocabulary
5. Woodcock-Johnson Revised Test of Achievement (WJ-R): Comprehension

The results of data analysis indicated that, at the end of the intervention, there were statistically significant improvements in student performance on all measures for the treatment group, when compared to the control group. The two-year follow-up

measurements revealed that reading skills of most treatment groups continued to outperform reading skills of control groups, especially on oral reading fluency measures. However, vocabulary measures didn't show significant differences between treatment and control groups at follow-up. The study suggests that explicit instruction and practice in phonemic awareness and phonics contributes to reading skill.

In the subgroup analysis, the Hispanic students benefited from the supplemental reading instruction as much as their non-Hispanic peers despite the fact that Hispanic students has different levels of initial English proficiency. Another analysis showed that participants who were selected based on behavior criteria had higher entry levels than students who were selected based on literacy criteria. However, the latter group demonstrated greater improvement in their reading skills than the former group. The study also suggested that students who were selected based on behavior criteria made greater gains on reading assessments than students with behavior problems in control groups. Further, the study found that the intervention had similar benefits in improving reading skills for both older (2^{nd} and 3^{rd} grades) and younger students (K and 1^{st} grade).

APPENDIX C

SCHWARTZ (2005)

Schwartz, R. M. (2005). Literacy learning of at-risk first-grade students in the reading recovery early intervention. *Journal of Educational Psychology, 97,* 257-267.

The purpose of this web-based study was to examine the effectiveness and efficiency of the Reading Recovery program. The author asked cooperating teachers to identify two at-risk first grade students in their classrooms and randomly assigned them to first- or second-round Reading Recovery treatments. The teachers also identified two additional students from high-average and low-average reading skill groups in the same classrooms to serve as control samples. In total, participants were 148 first grade students from 14 states. Nearly half of the participants were European American, 40% were African American, 12% were Hispanic, and 2% were Asian.

Students who were in the first- or second-round Reading Recovery conditions received a 20-week, one-on-one, 30-minute daily lesson in addition to their regular classroom instruction. The high- and low-average students did not receive any additional support. Implementers were classroom teachers who received Reading Recovery training. To assess students' performance in early literacy, the researcher collected student data on ten measures across the course of the school year. Data was collected at the beginning of school year, at the transition of first- to second-round treatments, and at the end of the

school year. The measures used in the study and their foci were:

1. The Text Level Task— a series of tasks to identify individual reading levels
2. Letter Identification— an oral response test of 26 upper and 28 lower case letters
3. Concepts About Print— an oral test of knowledge of conventions and print
4. Ohio Word Test— an accuracy reading test of 20 high-frequency words
5. Writing Vocabulary— a 10-minute word writing test with a prompt
6. Hearing and Recording Sounds in Words— an accuracy test of dictating five passages
7. Phoneme Segmentation Test— an accuracy test of segmenting 22 whole words
8. Syllable/Sound Deletion Task— a task of deleting phonemes within words
9. Slosson Oral Reading Test-Revised—a reading test of lists of real words (20 words per list)
10. Degrees of Reading Power— a test of selecting the appropriate words to complete the sentences of a passage

The overall results of the study demonstrated that the Reading Recovery intervention effectively and efficiently impacted at-risk students' skills in basic literacy. The transition results demonstrated that the first round students, who had already received intervention, performed better than second round students, who had not yet received intervention. The first round of students also performed in the middle range when compared with low and high average students, and were able to gradually catch up to high average students. Gains on phonemic measures were significant, except for the comprehension measures. It is notable that the second round students showed the greatest increase on the phonemic measures after intervention.

Two aspects of the efficiency of the intervention were examined: (a) the number of students identified as at-risk who made adequate progress without intervention, and (b) the reduction of students who needed long-term literacy support. The study found that 14% of the students achieved adequate scores without intervention, with the remaining 86% of the students needing intervention. Additionally, the study used measures of first and second round intervention and suggested that after intervention, only 5% of students would still need long-term support compared to 17% of students who had not received a literacy intervention. The study suggests that timely intervention targeting early literacy skills will effectively and efficiently impact the reading skills of students at-risk for reading disabilities.

APPENDIX D

SIMMONS ET AL. (2007)

Simmons, D. C., Kame'enui, E. J., Harn, B., Coyne, M. D., Stoolmiller, M., Santoro, L. E., Smith, S. B., Beck, C. T., & Kaufman, N. K. (2007). Attributes of effective and efficient kindergarten reading intervention: An examination of instructional time and design specificity. *Journal of Learning Disabilities, 40,* 331-347.

The authors examined two critical variables that are believed to influence students learning, especially for students at risk of learning disabilities: instructional time and design specificity. This experimental study compared three instructional interventions that contrasted these dimensions across varied content. The intervention of 30/H (30 minutes of highly specified instruction) focused primarily on teaching students skills in phonemic awareness, alphabetic understanding, letter writing, and spelling. The 15/H+15 (15 minutes of highly specified instruction with 15 minutes of storybook activities) intervention also taught phonological, alphabetic, and orthographic skills but also included 15 minutes of intervention focused on storybook reading (vocabulary, comprehension, and story retell). The 30/M (30 minutes of commercial textbook) intervention focused on teaching students skills in phonemic awareness, alphabetic understanding, letter writing, and spelling; however the nature of instructional delivery and content was not as carefully controlled as the former highly specified interventions.

Kindergarten students from seven elementary schools (all receiving Title I funding) located in the Northwest area of the U.S. were screened in September of the study year on Letter Naming Fluency (LNF) and Onset Recognition Fluency (OnRF) of Dynamic Indicators of Basic Early Literacy Skills (DIBELS). Students who scored below the 25th percentile with no severe hearing or visual disabilities or limited English proficiency participated in the study (N = 96). Interventionists included 4 certified teachers and 24 educational assistants with an average of 5.7 years of instructional experience in schools.

Students were randomly assigned to intervention type and were in instructional groups of four to five students. The intervention ran from November through mid-May (about 108 days, for a total of 54 hours), and each student received the 30 minute intervention in addition to their 2.5 hours school day. Nine dependent measures assessed four dimensions of early literacy skills which included:

1. Phonological awareness:

   Yopp-Singer Test of Phoneme Segmentation— an accuracy-based test of the segmentation of whole words

   DIBELS Onset Recognition Fluency (OnRF)— a fluency-based test of the recognition and production of the initial sound in an orally presented word

   DIBELS Phonemic Segmentation Fluency (PSF)— a fluency-based test of the segmentation of individual phonemes in 3- to 4-phoneme words presented orally.

2. Decoding and word reading:

   DIBELS Nonsense Word Fluency (NWF)— a fluency-based test of CVC pseudowords.

The Woodcock Reading Mastery Test–Revised, Word Attack subtest— an accuracy-based test of pseudoword reading.

The Woodcock Reading Mastery Test–Revised (WRMT-R), Word Identification subtest— an accuracy-based test of real word reading.

3. Orthographic Development:

   Letter Dictation Fluency— a written fluency-based test of 26 upper or lowercase letters.

   Tangel and Blachman Spelling— an accuracy-based dictation test of real word reading.

4. Vocabulary:

   Peabody Picture Vocabulary Test-Revised (PPVT-R)— a test to assess students' receptive vocabulary skills.

Treatment integrity was examined by observers eight times during the intervention period. Interobserver reliability was calculated at a rate of .85 or higher. The treatment integrity for each of the intervention conditions revealed no significant differences in the integrity of implementation of the intervention.

The data was analyzed based on instructional time (30/H vs. 15/H+15), instructional design specificity (30/H vs. 30/M) and combined time and design (15/H+15 vs. 30/M). In comparison of the length of instructional time, the authors found students demonstrated similar growth on phonemic awareness skills. However, on untimed decoding, word reading, and orthographic development, students in the 30/H groups showed significantly greater improvement than students in 15/H+15 group. The authors also found that for students with the lowest initial skills, students in the 30/H group made significantly more

growth on measures of decoding, word reading, and orthographic development than similarly performing students in the other interventions. When examining the role of instructional design specificity, students in the 30/H intervention performed significantly better across most early literacy measures compared to the other interventions.

The findings of the study suggested that instructional time and the specificity of instructional design and delivery have a significant impact on improving alphabetic and orthographic skills for students at-risk for later reading difficulties. Additionally, the results indicate that students with the least skills may demonstrate significant growth when given highly specified interventions.

APPENDIX E

VADASY ET AL. (2006)

Vadasy, P. F., Sanders, E. A., & Peyton, J. A. (2006). Code-oriented instruction for kindergarten students at risk for reading difficulties: A randomized field trial with paraeducator implementers. *Journal of Educational Psychology, 98,* 508-528.

The purpose of the study was to examine the effectiveness of explicit supplemental one-on-one instruction in alphabetic and phonemic decoding skills provided by instructional assistants. The study also examined students' skills at a one-year follow-up to understand how reading skills maintained over the second half of kindergarten year. Participants (N = 67) were kindergarten students who were referred by their teachers, met the screening criteria, and fell in the at-risk range on DIBELS subtests. The ethnicity of the participants was primarily non-Caucasian (86%). They were randomly assigned to a supplemental instructional group or control condition. Students in the supplemental groups received supplemental instruction four times a week for 18 weeks in addition to their regular reading instruction during the school day. The supplemental lessons were 30-minute scripted lessons for 62 sessions, emphasizing basic literacy skills and practices (i.e., letter-sound correspondence, phoneme segmenting, word reading and spelling, irregular word reading, phoneme blending, alphabet naming, and oral reading). The implementers were trained instructional assistants coached by the researchers at each

participating school. Treatment fidelity was rated 3.64 on a 0 to 4 scale, where 0 indicated a total lack of fidelity of implementation, and 4 indicated perfect implementation.

Ten measures were used to assess students' behavior and early literacy skills. Measures of classroom behavior, receptive language, phonological skills, alphabetic knowledge, and reading accuracy were administered before intervention. After intervention, all measures were administered except for the classroom behavior and receptive language measures. The measures were defined as follows:

1. Behavior: Multigrade Inventory for Teachers (MIT), Behavior Scale
2. Receptive language: Peabody Picture Vocabulary Test-IIIA (PPVT-IIIA)
3. Alphabetic knowledge: Dynamic Indicators of Basic Early Literacy Skills, Letter Naming Fluency (DIBELS-LNF)
4. Phonological Awareness: Comprehensive Test of Phonological Processing Phonological Awareness (CTOPP-PA)
5. Reading accuracy: Woodcock Reading Mastery Test—Revised/Normative Update (WRMT-R/NU), Word Attack and Word Identification subtests
6. Reading efficiency: Test of Word Reading Efficiency(TOWRE), Phonemic Decoding Efficiency and Sight Word Efficiency subtests
7. Oral reading fluency: words correct per minute on a beginning first-grade text passage from *Primary phonics* (Makar, 1995).
8. Developmental spelling: Wide Range Achievement Test—Revised (WRAT-R), Spelling subtest
9. Comprehension: Woodcock Reading Mastery Test—Revised/Normative Update (WRMT-R/NU), Passage Comprehension subtest

The results showed that treatment groups demonstrated greater improvement than their control group peers. The study found that code-based individual tutoring significantly impacted kindergarten students who were at-risk for difficulty with reading and spelling skills. Students in the treatment group who performed below the 13th percentile on phonemic and alphabetic tasks demonstrated progress after intervention, scoring in the 45th percentile on measures of reading accuracy and the 32nd percentile on measures of reading efficiency. In addition, the study found that instruction delivered by instructional assistants was as efficient and effective as instruction delivered by certified teachers. The one year follow-up study assessed students in the areas of decoding, word reading fluency and efficiency, developmental spelling, and comprehension skills. Based on the results of the follow-up assessment, treatment groups maintained better performance on measures of reading accuracy and efficiency than control groups. However, it should be noted that seven out of nine participating schools administered one-on-one tutoring and support to first grade students who had participated in the research as kindergarteners, which may have impacted follow-up results.

APPENDIX F

TABLES

Table 1. Features of Intervention Studies

Study	Study Characteristics		Intervention Features				
	N and Identification Criteria	Grade	Intervention Frequency	Duration	Group Size	Implementer	Interventional Intensity
Denton et al. (2006)	27 with persistent deficits in reading (not responsive to 2 years of intervention and/or <30% on WJ-III Basic Skills Reading)	1-3	1st 8 weeks: 50 minutes /twice a day 2nd 8 weeks: 1hr/day	16 weeks	2	Certified Teachers	High (Phono-Graphix) Medium (Read Naturally)
Gunn et al. (2005)	299 with reading deficits (<5% on DIBELS and/or aggressive social behavior (>95% on ASCBCL)	K-3	50 min, 5 days/week	2 years	2-3	Instructional assistants	High (Reading Mastery- 1st and 2nd grade, Corrective Reading- 3rd and 4th grade)
Schwartz (2005)	148 at-risk (teacher reported low performance)	1	30 min, 5 days/week	1 year, 20 weeks/ round	1	Certified teachers	Medium (Reading Recovery)

Table 1 (Cont.). Features of Intervention Studies

Study	Study Characteristics		Intervention Features				
	N and Identification Criteria	Grade	Intervention Frequency	Duration	Group Size	Implementer	Interventional Intensity
Simmons et al. (2007)	96 at risk (< 25% on PA + LNF)	K	30 min, 5 days/week	108 days (about 22 weeks)	>5	Certified teachers and instructional assistants	Three groups: High (30/H: 30 min. of Highly specified instruction) High (15/H+15:15 min. of Highly specified instruction +15 storybook activities) Medium (30/M: 30 min. of commercial textbook)
Vadasy et al. (2006)	67 at risk (< 30% on PA+ LNF)	K	30 min, 4 days/week	18 weeks	1	Instructional assistants	High (62 scripted lessons in phonemic and alphabetic skills)

Note. N = Number of students; K = Kindergarten; WJ-III = Woodcock-Johnson Test of Achievement, third edition; DIBELS = Dynamic Indicators of Basic Early Literacy Skills; ASCBCL = Aggression scale of the Children Behavior Checklist; PA = Phonemic awareness; LNF = Letter naming fluency.

Table 2. Effect Size by Measure and Group Comparison

Study	Intervention (& Intensity)	Measure	Effect Size		
Denton et al. (2006)	Phono-Graphix (High) Read Naturally (Medium)		Phono-graphix pre/ post	Read naturally pre/ post	Combined program pre/ post
		WJ-III Word Attack	1.77	- .18	1.32
		WJ-III Letter-Word Identification	.93	.29	1.17
		WJ-III Spelling	.53	.28	.84
		TOWRE-Sight Word Fluency	.44	.57	.99
		TOWRE- Phonemic Decoding Fluency	.88	.43	1.22
		GORT-4 Fluency	.47	.76	1.53
		WJ-III Passage Comprehension	.67	.23	.84
		GORT-4 Comprehension	.66	.19	1.00
Gunn et al. (2005)	T: Supplemental Reading Instruction (Reading Mastery for 1st - 2nd grades and Corrective Reading for 3rd - 4th grades) (High) C: No Treatment		T vs C		
		WJ-R Letter-Word ID	.19		
		WJ-R Word Attack	.49		
		Oral Reading Fluency	.18		
		WJ-R Vocabulary	.18		
		WJ-R Comprehension	.18		

Table 2 (Cont.) Effect Size by Measure and Group Comparison

Study	Intervention (& Intensity)	Measure	Effect Size		
Schwartz (2005)	Group 1: Reading Recovery 1st round (Medium) Group 2: Reading Recovery 2nd round. (Medium)		Group 1 pre/ post	Group 2 pre/ post	
		Slosson Oral Reading Test-Revised	N/A	1.44	
		Degrees of Reading Power	N/A	.47	
		Phoneme Segmentation Test	N/A	.61	
		Syllable/sound Deletion Task	N/A	.49	
Simmons et al. (2007)	T1: 30-min of high-specificity design intervention (High) T2: 15-min of high-specificity design and 15-min storybook intervention (High) T3: 30-min of moderate-specificity design intervention (Medium)		T1 pre/ post	T2 pre/ post	T3 pre/ post
		DIBELS LNF	2.99	2.42	2.58
		DIBELS OnRF	2.37	1.84	1.77
		Yopp-Singer	1.10	2.01	1.14
		Letter Dictation Fluency	1.86	1.87	1.84
		TB Spelling	3.93	2.39	2.04
		PPVT-R	.52	.05	.21

Table 2 (Cont.). Effect Size by Measure and Group Comparison

Study	Intervention (& Intensity)	Measure	Effect size		
Vadasy et al. (2006)	T: integrated and explicit instruction in phonemic and alphabetic skills (High) C: No Treatment		T v C		
		DIBELS LNF	.08		
		CTOPP-PA	.27		
		WRMT-R/NU Word Attack & Word Identification	.95		
		TOWRE Phonemic Decoding & Sight Word Efficiency	.50		
		Oral Reading Fluency	.81		
		WRAT-R Spelling subtest	.58		
		WRMT-R/NU Passage Comprehension	.28		

Note. WJ-III = Woodcock-Johnson Tests of Achievement- Third Edition; TOWRE = Test of Word Reading Efficiency; GORT-4 = Gray Oral Reading Test-Fourth Edition; WJ-R = Woodcock-Johnson Revised; DIBELS LNF = Dynamic Indicators of Basic Early Literacy Skills- Letter Naming Fluency; DIBELS OnRF = Dynamic Indicators of Basic Early Literacy Skills- Onset Recognition Fluency; Yopp-Singer = Yopp-Singer Test of Phoneme Segmentation; TB Spelling = Tangel and Blachman Spelling; PPTV-R = Peabody Picture Vocabulary Test-Revised; CTOPP-PA = Comprehensive Test of Phonological Processing Phonological Awareness; WRMT-R/NU = Woodcock Reading Mastery Test-Revised/ Normative Update; WRAT-R = Wide Range Achievement Test-Revised; T = treatment group; C = control group.

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