

Effectiveness of a Collaborative, Multi-Component Intervention for Adolescent Students with Severe Reading Disabilities

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Abstract: The purpose of this study was to evaluate the effectiveness of a collaborative, multi-component reading intervention approach for adolescent students in high school with severe reading disabilities. Students in the experimental condition received 24 weeks of multi-component, differentiated small group interventions from a special-education teacher, a speech pathologist, and a paraprofessional with time to engage in cooperative groups and practice skills to mastery. Monthly progress monitoring informed the instructors of ongoing progress and drove instructional components based on student learning. The control group received whole classroom instruction combined with traditional, special educational supports. The results showed significant differences in growth between conditions on standardized measures of word reading fluency, oral reading fluency, and reading comprehension with medium effect sizes. No differences were noted in standardized vocabulary growth. Grade level progress in reading was not observed for either the experimental or the control groups; however, outcomes indicated only three “nonresponders” in the experimental group compared to six in the control. Findings are discussed in regard to practical application, limitations, and future research.

Keywords: Adolescent, differentiated instruction, intervention, severe reading disabilities.

INTRODUCTION

At present, 45 states have elected to adopt *The Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects* (CCSS, 2011a). The Common Core State Standards CCSS are designed to be research based, internationally benchmarked, and aligned with college and career work expectations. They include rigorous content and skills that form the basis for classroom instruction in literacy to ensure all students are ready for post-secondary opportunities by the end of high school. With the idea of ensuring readiness for all students, the guidelines suggest additional instructional supports and accommodations for students can be made for students with disabilities (CCSS, 2011b).

Results from the National Assessment of Educational Progress (NAEP, 2011) indicate that approximately 64% of eighth graders with disabilities scored below proficient on their ability to comprehend grade level text compared to 18% of eighth graders without disabilities. This disparity demonstrates the need for administrators, educators, and support staff to increase accommodations and instructional supports for secondary students with disabilities in the area of reading. It is critically important that adolescent students with severe reading disabilities receive intensive research-based interventions that effectively and efficiently address their individual learning needs as they progress through their high school years in order to be ready for post-secondary experiences.

EVIDENCE BASED PRACTICE: INTERVENTIONS FOR SECONDARY STUDENTS

A number of empirical reviews and meta-analyses (Edmonds *et al.*, 2009; Gersten *et al.*, 2001; Mastropieri *et al.*, 2003; Scammacca *et al.*, 2007; Solis *et al.*, 2012, Swanson, 1999; Vaughn *et al.*, 2000) have reported positive intervention effects for secondary students with reading difficulties or disabilities. For example, (Edmonds *et al.*, 2009) examined 13 studies on reading comprehension in which instruction in decoding, fluency, vocabulary, or comprehension was provided to students in Grades 6 through 12. The following intervention components yielded moderate effect sizes: (a) interventions with a specific focus on reading comprehension, (b) interventions that utilized multiple reading components, and (c) interventions that incorporated word reading strategies. (Solis *et al.*, 2012) conducted a synthesis of 12 reading comprehension interventions for middle school students with learning disabilities. Interventions that included main idea summarization, strategy instruction, mapping, mnemonics, multi-components, and self-monitoring procedures yielded large effects for researcher developed measures and medium effects for standardized measures. This foundational knowledge should be utilized when planning strategic interventions for adolescent students with severe reading disabilities.

In addition to the empirical syntheses related to reading interventions, evidence based practice guides have been developed to provide recommendations for educators and practitioners when providing instruction to students with and without reading difficulties (Biancarosa & Snow, 2004; Kamil *et al.*, 2008). In 2008, the Institute of Educational

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Sciences (IES) issued an evidence-based guide on adolescent literacy (Kamil *et al.*, 2008). The following instructional recommendations were supported by moderate to strong evidence: (a) provide explicit vocabulary instruction, (b) provide direct and explicit comprehension strategy instruction, (c) provide opportunities for extended discussion of around text, (d) increase student motivation and engagement in literacy, and (e) provide readers who struggle with intensive individualized interventions delivered by trained personnel. In addition, the authors recommended students receive intensive intervention and small group instruction if reading below grade level.

IMPACT OF COMPONENTS OF READING ON ADOLESCENT READERS WITH READING DIFFICULTIES

Research shows that many older students with reading disabilities demonstrate difficulty with foundational reading skills such as word reading, reading fluency, poor vocabulary, and poor comprehension when reading grade level text (Cirino *et al.*, 2013). Their reading is often characterized by poor decoding or word identification abilities, slow and labored reading fluency, and deficits in comprehension that relate to inadequate vocabulary and inability to apply active comprehension strategies (Kamil *et al.*, 2008; Torgesen *et al.*, 2007). Subsequently, these characteristics present instructional challenges for teachers at the secondary level. The outcome of the National Reading Panel (NRP) report (2000) synthesized evidence of effective instruction in teaching beginning readers. The report identified five instructional areas crucial for children to become proficient readers, including phonemic awareness, phonics, fluency, vocabulary, and comprehension. In addition to the component areas, numerous researchers found that for beginning readers, explicit and systematic instruction should be provided in all the components (Fletcher *et al.*, 2005; NRP, 2000; National Research Council Report, 1998). However, these recommendations may not fit the prescriptive requirement when instructing older students with reading difficulties. (Roberts *et al.*, 2008) recommend an adjustment of these five essential areas for older students who have reading challenges to include the following: (1) word study, (2) fluency, (3) vocabulary, (4) comprehension, and (5) motivation.

Word-level reading. Older students who struggle with reading demonstrate inadequate word identification and decoding skills, particularly when encountering multisyllabic words (Archer *et al.*, 2003; Bhat *et al.*, 2003, Williams, 1980). Poorly developed word recognition skills are believed to be the most debilitating source of reading challenges (Adams, 1990; Share & Stanovich, 1995) and students with these types of deficits may never learn to read proficiently without effective word level decoding instruction (Bear *et al.*, 1996; Torgesen *et al.*, 2003). Intervention studies, ranging from the letter-sound level (e.g., Bhat *et al.*, 2003; Vellutino & Scanlon, 1987; Williams, 1980) to advanced word study strategy application (e.g., see Scammacca *et al.*, 2007 for review of research), have demonstrated positive effects for older students on word reading and reading comprehension.

Oral reading fluency. Older students who experience difficulty with reading generally do not read as fast or as precisely as students who are good readers (Adams, 1990; Mathes *et al.*, 1992). (Hasbrouk & Tindal 1992) define reading fluency as the ability to read words accurately and fluently. Extant research supports a reciprocal relationship between fluent oral reading and overall reading ability, including a facilitative role in reading comprehension (e.g., see National Reading Panel, 2000 for a review). For this reason, fluency measures are often utilized as an index of overall reading growth (Deno *et al.*, 2001). Students with poor oral reading fluency have been shown to receive less independent practice in reading and comprehend at a much slower rate than peers without difficulties (Allington, 2001; Mastropieri *et al.*, 1999). Reading fluency can be improved for older struggling readers through intervention, particularly when engaging in repeated reading while receiving instructional feedback (Meyer & Felton, 1999; Rashotte & Torgesen, 1985). Further, repeated reading interventions may have added instructional value if repeated practice is paired with word learning instruction (Roberts *et al.*, 2008).

Vocabulary. In addition to poor reading fluency, older students who struggle with reading often have depressed vocabulary levels when compared to peers without difficulties (Ebbers & Denton, 2008). According to (Nagy *et al.*, 1984), readers with typical skills develop a significant amount of vocabulary through wide independent reading. Numerous encounters with new words facilitate greater word knowledge through these encounters (Nagy and Scott, 2000). Students with reading difficulties spend less time reading independently, limiting encounters with new words and, subsequently, inhibiting their vocabulary growth (Cunningham & Stanovich, 1998; Baker *et al.*, 1998).

Researchers have stated that there is little emphasis on vocabulary instruction in current primary curricula (Beck, McKeown, & Kucan, 2002; Biemiller, 2004) and that schools need to focus on enhancing children's vocabulary (Biemiller & Boote, 2006). One means of doing so may be to provide direct vocabulary instruction. Direct vocabulary instruction has been shown to be effective for older students with reading difficulties (Jitendra *et al.*, 2004; Stahl & Nagy, 2006) and is particularly effective when strategies facilitate word learning, including (a) teaching word study strategies that fuse root words and affixes particularly when instruction is aligned to the students reading developmental age (Reed, 2008), (b) using semantic maps (Kim *et al.*, 2004), and (c) providing numerous exposures of the new word (Beck *et al.*, 2002).

Comprehension. Secondary to the aforementioned difficulties and coupled with the avoidance to independently read, students with reading challenges miss opportunities to develop and skillfully apply reading comprehension strategies, resulting in significant deficits in the most important area of reading (Edmonds *et al.*, 2009; Gersten *et al.*, 2001). Reading comprehension is a complex process that requires constructing and extracting meaning from written texts (Baker & Brown, 1984; Faggella-Luby & Deshler, 2008; NRP, 2000). Recent researchers have found that targeted strategy instruction, when taught in an overt and

explicit manner, improves reading comprehension for struggling readers, including: (a) identification of narrative and expository text structures, (b) tapping into prior knowledge, (c) the use of cognitive strategies such as self-monitoring, summarizing, and self-questioning, and (d) engaging in cooperative learning (Swanson, 1999). Additional research by (Calhoon 2005), accelerated comprehension in middle school students with reading difficulties utilizing a “Partner Reading” strategy in which students summarized, applied main idea identification strategies, and conducted prediction confirmations collaboratively. In addition to strategy instruction, practicing strategies to a mastery level has been shown to have an effect on long-term maintenance (Mastropieri & Scruggs, 1997).

Attitudes. After years of struggling to acquire foundational reading, older students with reading difficulties often possess negative attitudes toward reading (Oka & Paris, 1986) and lack the motivation necessary to independently engage in reading activities (Morgan & Fuchs, 2007). Recent research found a significant increase in struggling readers’ motivation to participate and complete modules in reading comprehension when art was utilized as the instructional modality (McDowell & Ziolkowski, 2008). According to (Guthrie & Humenick 2004), providing interesting content goals for reading, supporting student autonomy, providing interesting texts, and increasing social interactions related to reading are vital for increasing students’ motivation to read.

INSTRUCTIONAL CONSIDERATIONS

Researchers specify that instructional designs for older students who demonstrate reading deficits should be effective enough to close the gap with standards at students’ grade level (Roberts *et al.*, 2008) and be provided by trained specialists (Kamil *et al.*, 2008). In order to reach this goal, we must look to prior research and build interventions that use the most robust pedagogical components (Faggella-Luby & Deshler, 2008) and that are “explicit and comprehensive, more intensive, and more supportive” than most students require (Foorman & Torgesen, 2001). Additionally, instruction that utilizes explicit/direct teaching (Carnine *et al.*, 2006), integrates accuracy, fluency, and comprehension (Cirino *et al.*, 2013), provides positive emotional support, and repeated practice has led to powerful student outcomes (Calhoon *et al.*, 2010; Lovett *et al.*, 2000; Rashotte *et al.*, 2001) for early readers with reading difficulties and may achieve similar outcomes when applied to older, struggling readers.

An instructional strategy that provides additional opportunities to practice and respond is Classwide Peer Tutoring (CWPT: Greenwood *et al.*, 2007). CWPT pairs students into competing or cooperating teams requiring students to work together. This strategy has been shown to be effective for teaching academic and social skills to older students (Wehby *et al.*, 2003). Research has demonstrated that CWPT keeps students actively engaged nearly 100% of the time, and practice on skills is doubled or tripled over a teacher’s classroom instruction.

Despite the fact that there has been significant attention and focus on reading proficiency and education in

elementary school, and emerging evidence in secondary, many adolescent students continue to struggle into their high school years (Cirino, 2013; Wanzenk, *et al.*, 2013). Researchers suggest this is due to the application of ineffective teaching methods combined with instructional strategies that do not have a sound research base (Moats, 2001). In addition, a crucial element in intervention is to provide an explicit instructional focus to meet individualized learning needs (Kamil *et al.*, 2008) and improve academic achievement for all students. However, many school districts continue to implement a “one size fits all” curriculum in the upper grades. Studies indicate that teachers have minimal time to devote to individualized instruction and lack the knowledge and skills to address significant reading challenges (Gill & Kozloff, 2004; Kamil *et al.*, 2008).

With these limitations in mind, the Active Reader Intervention Program was developed (ARI, Ziolkowski & McDowell, 2008). Building on the successful work of others in adolescent literacy (Calhoon *et al.*, 2013), our purpose was to add to the scant body of literature documenting the effects of multi-component interventions for adolescent students who struggle with foundational reading skills. Specifically, this study sought to determine the impact of a multi-component intervention approach that utilized collaborative small group instruction taught by specialists for students in high school with severe reading disabilities. The following research questions were addressed:

1. Can adolescent students with reading disabilities in the strategic, scientific-based reading intervention program make significantly greater gains in reading skills than in a traditionally taught whole-class remedial reading program?
2. Is the collaborative model of delivering intervention successful for students with severe reading disabilities in high school?

MATERIALS AND METHODOLOGY

Participants

Prior to the study, administrative personnel and school board members from a western medium-sized rural school district agreed to allow participation of the district high schools. All schools were on a traditional schedule of instruction (i.e., August through June). Three high schools agreed to participate in the study. Schools reported the percentage of free and reduced lunch status of 32.48%, 37.22%, and 48.45%. The three schools were randomly assigned to the treatment and comparison conditions (two treatment schools and one control). All of the special education teachers and support staff (i.e., speech-language pathologists and special education paraprofessionals) agreed to participate. The research was conducted with institutional review board approval.

Three special education teachers, speech-language pathologists (SLPs), and special education paraprofessionals were recruited from each site to participate. All of the special education teachers met state certification requirements and each was licensed to teach at the secondary level. Mean age was 33.63 years (SD=6.58, range 228-41); the mean number of years as teacher in special education was 5.67 years (SD 2.08, range 4-8 years). The three SLPs were nationally

certified and each held a professional educational certification and national certification. Mean age was 30.23 years (SD=3.31, range 27-34); the mean number of years as a SLP in an educational setting was 5.33 years (SD 1.52, range 5-7 years). Two of the paraprofessionals held Associate of Arts degrees; one in Early Childhood and the other in General Studies. The third paraprofessional was enrolled in an undergraduate special education program. Mean age was 39.06 years (SD=3.25, range 35-41); the mean number of years as a paraprofessional in an educational setting was 13.33 years (SD 6.42, range 6-16 years). Chi-square analysis for categorical variables was conducted. No significant differences were found between the school support teams (i.e., teachers, SLPs, and paraprofessionals) for gender ($\chi^2(2) = 2.25, p > 0.05$), ethnicity ($\chi^2(2) = 3.0, p > 0.05$), or highest degree earned ($\chi^2(4) = 9.0, p > 0.05$). A one-way ANOVA indicated no significant differences for age, $F(2,6) = 2.27, p > 0.05$, or for number of years in education, $F(2,6) = 1.17, p > 0.05$.

Students. After school assignments were made, participants were selected by district special education administrators and special education teachers based on the following: (a) an Individual Education Program reflecting a severe learning impairment in reading; (b) placement in a special education language arts resource classroom where instruction was provided by special education staff; (c) no record of receiving English as a Second Language support or instruction; and (d) Intelligence Quotient of 71 or above. A total of 28 ninth through 12th grade students met participation criteria to be included in the study. Parental consents for student participation were obtained prior to student testing. Students in the experimental condition attended two separate schools; five in one and six in the other. Students in the control condition attended the same high school.

Chi-square analysis was used on student demographic categorical data. No significant differences were found between experimental and control participants on gender, ethnicity, grade level, years retained, or free or reduced lunch status. An independent t-test revealed no significant differences between the groups on age or IQ. See Table 1 for demographic and descriptive data.

Measures

Test of Word Reading Efficiency (TOWRE; Torgesen *et al.*, 1999). The TOWRE is an individually administered, timed, norm-referenced test available in two alternate forms. The Phonetic Decoding Efficiency subtest assesses the number of nonwords accurately decoded in 45 seconds and the Sight Word Efficiency subtest measures the number of real words identified in 45 seconds. Test retest reliability coefficients range from .90 to .95. This test was administered at beginning of the school year (pretest), at midyear, and at the end of the year (posttest).

Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997). The PPVT-III measures a student's receptive vocabulary. It is an individually administered, untimed, norm-referenced test available in two alternate forms. Students are shown a page with four pictures, and are asked to identify the picture that best depicts the target vocabulary

word by either pointing or verbalizing. Test-retest reliability coefficients are estimated to be between .93 and .94. Alternate form reliability coefficients range from .88 to .96. This test was administered at the beginning of the beginning of the school year (pretest) and at the end of the year (posttest).

Gray Oral Reading Test – Fourth Edition (GORT-4; Wiederholt & Bryant, 1992). The GORT-4 is an individually administered, timed, norm-reference measure of reading accuracy, rate, and comprehension. It contains 13 graded reading passages available in two alternate forms. Students read passages aloud and then answer five comprehension questions. Testing yields individual subtest scores and an overall reading quotient. Reliability coefficients range from .78 to .95. This test was administered at the beginning of the school year (pretest), in the middle of the year and at the end of the year (posttest) using alternate forms.

Progress Monitoring

To measure reading skill acquisition and responsiveness to intervention, WADE probes (alternate forms) and DIBELS ORF (alternate forms) were administered once a month to experimental participants.

Wilson Assessment for Decoding and Encoding (WADE; Wilson, 1988). The WADE is a criterion-referenced assessment of reading and spelling. It assesses a student's knowledge of the alphabetic principle (identifying letters and sounds), reading real words, reading nonsense words, reading sight words, spelling real words, spelling nonsense words, and spelling sight words. It contains alternate forms.

Dynamic Indicators of Oral Reading Fluency (DORF; Good & Kaminski, 2002). The DORF is a standardized measure that assesses reading fluency in connected text. It is designed to monitor reading fluency progress and identify students who are in need of additional instructional support. Students read three passages aloud for 1 min each. Words omitted, substituted, and hesitations of more than three seconds are scored as errors. Words self-corrected within three seconds are scored as accurate; the median score from the three passages is the data point for decision-making. On DIBELS ORF passages, alternate-form reliability drawn from the same level ranged from .89 to .94, and test-retest reliabilities for elementary students ranged from .92 to .97.

Group placement was reevaluated monthly based on DORF scores and progress demonstrated within centers. As per teacher report, students in the control condition were graded and monitored by the special education teacher on the work produced related to the (*Houghton Mifflin Language Arts*, 2003) program and (*Reading Mastery*, 1995) upper elementary program.

Intervention

Students enrolled in the experimental program received inclusive scientific based reading instruction five days a week, 60 minutes a day, for 24 weeks. Before intervention began, an intervention calendar was constructed with the special education teachers, SLPs, and paraprofessionals to determine the impact of school events, a field trips, and district-wide teacher an in-service days on planned

Table 1. Student demographic data by risk status and condition.

Variables	Experimental Condition			Comparison Condition			<i>F^a</i>	<i>(df)</i>	<i>x²</i>
	<i>n</i>	<i>M</i>	<i>(SD)</i>	<i>n</i>	<i>M</i>	<i>(SD)</i>			
Age in Years	13	17.05	(1.00)	15	16.72	(1.21)	-.488	(1,27)	
IQ		81.38	(9.69)		87.00	(10.21)	2.20	(1,27)	
Gender									
Male/Female	9/4			6/9					.258
Race/Ethnicity									
Hispanic-American		4			3				.20
Caucasian		8			10				
African American		1			1				
Other		0			1				
Grade									.58
Ninth grade		0			5				
Tenth grade		4			5				
Eleventh grade		7			2				
Twelfth grade		2			3				
Years Retained									1.16
None		8			3				
One		5			12				
Free/Reduced Lunch		9			8				.738

Note: CA = Caucasian American ; HA = Hispanic American; AA=African American; *F^a* = No contrasts were significantly different; *x²* = No contrasts were significantly different.

intervention time. Five days were “excused” from the required intervention time resulting in treatment being held five days a week, 60 minutes a day, for 24 weeks, resulting in 120 hours of instruction.

Students were divided into small groups (i.e., between 2 and 3 students) based on an analysis of their WADE Summary of Scores, initial DORF, and on the comprehension measure of the GORT-4. The intervention program incorporated leveled materials that ranged from 1st grade reading level (3rd grade interest) to 12th grade reading level. Students engaged in either direct instruction or cooperative learning at each center for 15 minutes. A timer indicated when students were to switch to a new center.

Instruction was implemented in a differentiated, culturally responsive, and strategic manner that responded to the reading levels and needs of the academically diverse students in the experimental classrooms. Based on recommendations from extant research, the following instructional components were implemented in each of the instructed centers: (a) “quick” daily reviews of previously covered material, (b) clearly stated purpose of the lesson, (c) explicit and direct strategy instruction, (d) teacher modeling using a think-alouds, (e) guided practice, (f) motivating and culturally sensitive corrective feedback, (g) independent

practice, and (h) generalization practice (Masteropieri *et al.*, 1999). Students were to be actively engaged in center activities with multiple opportunities to respond and interact with the teacher and other students.

Teacher/SLP/Paraprofessional Training. Training took place one week before the start of the school year. All teachers, SLPs, and paraprofessionals participated in 24 hours of training (four 6 hour sessions) provided by the first author. Training addressed instructional techniques and critical components of the intervention, including: (a) content of the teacher instructed intervention components (i.e., phonics/word study, and guided reading), (b) effective instructional techniques such as direct and explicit instruction, error correction, pacing and skill mastery, and making instruction differentiated and strategic (c) content and management of cooperative learning centers (i.e., vocabulary and comprehension), (d) content and management of fluency center (i.e., partner reading), (e) progress monitoring and data driven instruction, and (f) small group management and grading. All participants engaged in simulated practice sessions with feedback provided by the trainers. Throughout the intervention, each intervention classroom was observed at least once a month. Feedback and suggestions were given if needed. Monthly meetings were held at each of the intervention schools to

address student progress monitoring data and additional implementation issues and concerns.

Student Training. During the first week of the intervention, students received extensive training and practice on roles and responsibilities when participating. Training addressed the following areas: (a) managing individual notebooks, (b) peer dyads (i.e., reading fluency), and (c) cooperative learning groups (i.e., vocabulary and comprehension). Students engaged in simulated practice sessions with feedback provided by the teachers, SLPs, an paraprofessionals.

Active Reader Intervention

Guided Reading Center. The guided reading center was instructed by the special education teacher. The district approved (*Houghton Mifflin Language Arts, 2003*) curriculum was the main module utilized. As students completed their weekly reading requirements, additional materials were implemented to meet students' cultural interest (i.e., short stories, newspaper articles, science articles, etc.) and ranged from 1st to 12th grade reading level. Fluency strategies included one of the following research based approaches dependent upon group instructional levels; (a) teacher provided model of fluent reading with proper pacing, phrasing, and expression followed by student choral reading practice (NRP, 2000), (b) students engaged in choral reading without teacher model (NRP, 2000), or (c) teacher or student read aloud and students followed along in book with frequent checks for reading. During oral reading, the teacher provided embedded correction for decoding unfamiliar or multisyllabic words if needed. A robust approach to vocabulary instruction was implemented that included the use of visualization/creating pictures of new words, semantic maps, direct instruction on root words, antonyms, synonyms, and words with multiple meanings, as well as the implementation of differentiated, direct instruction on research based comprehension strategies such as activating and using prior knowledge, summarization, question asking and answering, visualizing, the use of graphic organizers, predicting, and making inferences.

Phonemic Analysis/Word Study Center (PAWS). The PAWS center was instructed by the paraprofessional teacher. Depending on decoding and word level proficiency, students were instructed on one or more of the following skills; sound-symbol correspondences with consonants and vowels, phoneme analysis and blending, syllabication, compound words, word families, vowel variations, strategies for decoding multisyllabic words, reading regularly spelled, irregularly spelled, and high frequency words, reading short connected text containing phonetically controlled words, and differentiated, leveled analysis of root words, prefixes, and suffixes.

Fluency Center. Students worked in dyads (or as a triad if the group is uneven) at their developmental reading levels. Students were trained to monitor their own progress and track words per minute read on a fluency graph. Each week, students were pre-assigned new reading passages that were leveled in complexity (e.g., student with reading difficulty was assigned a passage that was tied to PAWS vowel digraph instruction whereas a student with more advanced reading completed a passage at a 7th grade reading level).

Students received new passages and both partners chorally read the passage, marking unfamiliar words. Teacher or SLP was consulted to review unfamiliar words with the students and listened to students performing a second reading. Students then worked independently. One partner read while the other peer timed the reader for one minute, following along on a copy the reading passage marking miscues. Miscues were brought to the attention of a teacher/SLP for instruction to avoid students practicing incorrectly. Students followed the rule, "No guessing aloud!". The passage was repeatedly read five times by each partner, for a total of 10 exposures. After five paired readings were completed, partners completed a short comprehension summary of the passage. All materials were retained in the student notebook for teacher review and grading.

Cooperative Learning Vocabulary and Comprehension Centers. A substantial body of research supports the use of cooperative learning to effectively increase the quality and quantity of academic success for students with and without disabilities (e.g., Gersten *et al.*, 2001; Mastropieri *et al.*, 2003; Slavin, 1994). The model of cooperative learning utilized in the experimental classrooms was based on our thoughts that we could link explicit strategy instruction learned in guided reading to active engagement in the cooperative learning centers (i.e., vocabulary and comprehension) for deeper processing and independent application of strategy use (Jitendra *et al.*, 2004; NRP, 2000). Cooperative learning in the experimental classrooms included the following components: (a) a group leader that was switched on a weekly basis so everyone had an opportunity to lead, (b) individual accountability (i.e., each person was responsible for completing the work prior to the group/paired discussion), (c) equal opportunities for success (i.e., students utilized rules for how to conduct disagreements), (d) task specialization (i.e., strategies were previously taught in the guided reading group, the focus at cooperative learning was on mastery), and (e) adaptation to individual needs (i.e., cooperative learning group materials were differentiated and leveled according to reading developmental age). Students worked together to complete the modules. All vocabulary and comprehension tasks were leveled and graduated in complexity to meet the diverse needs of all the students. The SLP instructed the students in the cooperative learning centers two days per week. She provided explicit and direct instruction on vocabulary and comprehension strategies, as well as supported learning of previously instructed strategies. All materials were retained in the student notebook for teacher review and grading.

Vocabulary. Leveled vocabulary tasks (i.e., first to twelfth grade words) focused on word type and concept development and included: synonyms, antonyms, multiple meaning words, understanding vocabulary in context, finding meaning from context clues, prefixes, suffixes, and root words. Students were required to independently formulate sentences using the new words. Sentences were shared with group members. Group members/pairs critiqued each other's sentences and helped one another with revisions.

Comprehension. Comprehension tasks focused on activating and using prior knowledge, summarization, question asking and answering, visualizing, predicting, and

making inferences. Students were required to chorally read the module aloud. Students held “seminar” to complete and discuss their answers.

COMPARISON CONDITION INSTRUCTION

Students in the comparison condition received district mandated remedial services, including remedial language arts/reading instruction in a self-contained classroom and speech and language therapy. Students in the comparison condition received the district allocated (*Houghton Mifflin Language Arts*, 2003) series five days a week as well as supplemental assistance from the (*Reading Mastery*, 1995) series. Observations of the control classrooms indicated reading instruction was teacher led and contained round-robin oral reading, silent reading, and teacher questioning for comprehension. The paraprofessional supported students individually after they requested assistance. The SLPs reported providing pull out services for individuals and small groups focusing on content area vocabulary and comprehension strategy instruction (i.e., summarizing, predicting, and making inferences).

Treatment Fidelity

To monitor treatment fidelity, a checklist of teacher and student behaviors was developed. Fidelity checks of each of the experimental classrooms were conducted in October, December, February, and May. On the basis of these observations protocols by two independent raters, the intervention was implemented with 92% fidelity, with a range of 100% inter-rater agreement. The most common reason for low fidelity scores was that students were demonstrating off task behavior in the comprehension group. As a final measure of fidelity, classrooms were videotaped in May and reviewed by the second author and another independent reviewer. On the basis of these reviews, there was 100% inter-rater agreement regarding adherence to the treatment protocol.

Data Collection

Before the onset of the experimental program and after 10 weeks and 24 weeks of inclusive intervention (respectively), students in both the treatment and comparison conditions completed a comprehensive assessment battery examining each student’s reading ability across the multi-component intervention areas (i.e., word identification, fluency, and comprehension). Vocabulary was tested pre intervention and post-intervention secondary to the alternate form not being available. The alternate forms of all other assessments were used. All individual testing took place in a quiet, distraction free setting. All testers were blind to the intervention and control conditions and were trained in the administration of the battery. Tests were scored by trained scorers who were also blind to the condition of the students.

Experimental Design

Data were analyzed based on experimental and comparison group assignment. Of particular interest was the differential effect of the inclusive scientific-based reading program across three different time points in the intervention (i.e., pre-intervention, mid-intervention, and post-intervention).

RESULTS

Pretreatment Differences

Univariate analyses of variance (ANOVAs) were conducted on pretest scores for the TOWRE, PPVT-III, and Gort-4 subtests for each participant group. Although groups were randomly assigned, the intervention group did differ statistically on the following assessments; (a) TOWRE, $F(1, 26) = 37.40, p < .001$, (b) PPVT III, $F(1, 26) = 13.23, p < .001$, (c) Gort-4 Oral Reading Fluency subtest, $F(1, 26) = 30.79, p < .001$, and (d) Gort-4 Oral Reading Comprehension subtest, $F(1, 26) = 13.22, p < .001$, in favor of the comparison group (see Table 2).

Post Treatment

A 3 (pretest, midyear, posttest) x 2 (intervention/control) repeated measure ANOVA was conducted on the following: (a) total Word Reading Efficiency Standard Score, (b) GORT-4 fluency standard scores, and (c) GORT-4 comprehension standard scores. Mauchly’s Test of Sphericity indicated that the assumption of sphericity had been violated, and therefore, a Greenhouse-Geisser correction was used. PPVT III analysis was conducted at pretest and posttest only. Effect sizes are reported for partial η^2 (Sapp, 2006) with recommended interpretations for social science data (Ferguson, 2009). Table 2 shows the means, standard deviations, and experimental, group, and interaction F values by time and measure for standard scores.

TOWRE. Repeated measures ANOVA, with Greenhouse-Geisser correction, was conducted to determine the impact of the intervention on standardized scores of word reading efficiency. Results showed statistically significant main effect of time, $F(1.45, 52) = 8.32, p < 0.003$, partial $\eta^2 = .24$ and a significant interaction effect between time and group, $F(1.45, 52) = 4.13, p < 0.035$, partial $\eta^2 = .14$. Because the interaction between time and group was significant, we chose to ignore the time main effect and instead examined the simple main effects, that is, differences among word efficiency outcomes for the intervention and the control separately. Post hoc analyses with Bonferonni adjustment revealed significant differences in word reading efficiency in the intervention group, $F(1.79, 21.55) = 7.81, p < 0.004$, partial $\eta^2 = .394$ (moderate effect) and significant differences for the control $F(2, 28) = 5.12, p < 0.031$, partial $\eta^2 = .268$ (moderate effect). Follow-up tests were conducted to evaluate the three pairwise differences among the means for the intervention participants and for the control. The results indicated that there were significant differences in word reading from pretest to midyear in both the intervention ($p < 0.04$) and the control group ($p < 0.05$). There were no significant differences in word reading from midyear to posttest in either group.

Peabody Picture Vocabulary Test-III Repeated measures ANOVA, with Greenhouse-Geisser correction, yielded no significant main effect of time on vocabulary growth, $F(1, 26) = .212, p < 0.649$, partial $\eta^2 = .008$ and no significant interaction effect $F(1, 26) = .171, p < 0.683$, partial $\eta^2 = .007$.

Table 2. Means, standard deviations, and F values, on reading measures by group.

	Intervention Condition (n= 13)	Comparison Condition (n= 15)			
Variable/Measure	M (SD)	M (SD)	Pretreat F ^a	Post treatment F ^b	Interaction F ^d
TOWRE					
Pretest	55.92 (7.43)	75.40 (9.15)	37.40**		
Midyear	59.07 (9.00)	72.86 (9.97)			
Posttest	61.15 (9.41)	77.46(10.88)		8.32**	4.13*
PPVT-III					
Pretest	81.76 (8.89)	93.00 (7.44)	13.23**		
Posttest	83.00 (10.44)	93.06 (10.40)		2.12	
Gort-4 Fluency					
Pretest	1.30 (0.63)	3.86 (1.55)	30.79***		
Midyear	2.15 (1.21)	3.86 (2.09)			
Posttest	2.15 (1.34)	4.13 (2.10)		2.69*	2.50
Gort-4 Comp					
Pretest	3.76 (1.42)	5.60 (1.24)	13.22**		
Midyear	5.23 (1.83)	5.80 (1.69)			
Posttest	5.92 (1.44)	5.60 (1.96)		7.18**	19.61***

Note: TOWRE = Test of Word Reading Efficiency (TOWRE; Torgesen et al., 1999); PPVT = Peabody Picture Vocabulary Test-III (PPVT-III; Dunn & Dunn, 1997); Gort-4 = Gray Oral Reading Test – Fourth Edition; Fluency = Fluency Subtest, Comp = Comprehension Subtest (GORT-4; Wiederholt & Bryant, 1992); ES = partial η²
^adf = (1,26)
^bdf = TOWRE (1.45, 52); GORT-4 Fluency (1.93, 52); ; GORT4-Comprehension (1.81, 52);
^ddf = TOWRE(1.45, 52); GORT4-Comprehension (1.81, 52);
 *p <0 .05; **p <0.01; ***p <0.000

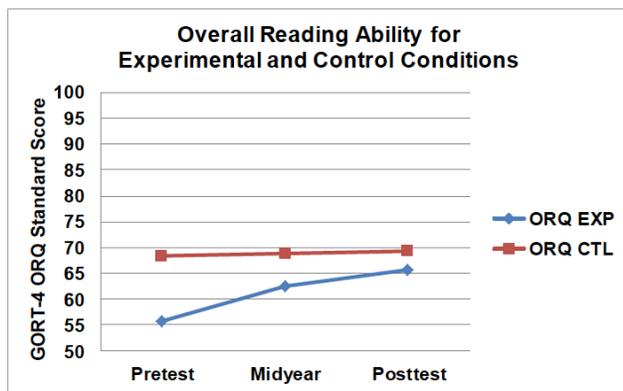


Fig. (1). Gort-4 oral reading quotient standardized scores for students in experimental and comparison groups.

GORT-4 Fluency subtest. Repeated measures ANOVA, with Greenhouse-Geisser correction, yielded a statistically significant main effect of time, $F(1.93, 52) = 2.69, p < 0.02$, partial $\eta^2 = .14$ (small effect). No significant interaction effect between time and group, $F(1.49, 52) = 2.50, p < 0.10$, partial $\eta^2 = .08$. Follow up analyses to the main effect for time using Bonferonni adjustment was performed for multiple comparisons among the three time points (pretest vs. midyear, midyear vs. posttest, pretest v. posttest). The results of these analyses revealed a significant increase in

reading fluency across all three time points for the intervention group but not for the control.

GORT-4, Comprehension subtest. Repeated measures ANOVA, with Greenhouse-Geisser correction, was conducted to determine the impact of the intervention on standardized scores of comprehension. Results showed statistically significant main effect of time, $F(1.81, 52) = 7.18, p < 0.003$, partial $\eta^2 = .22$, and a significant interaction effect between time and group, $F(1.81, 52) = 6.61, p < 0.004$, partial $\eta^2 = .20$.

Because the interaction between time and group was significant, we chose to ignore the time main effect and instead examined the simple main effect. A post hoc analysis with Bonferonni adjustment was utilized to determine separate differences among comprehension outcomes for the intervention and the control groups. Results revealed significant gains in reading comprehension in the intervention group, $F(1.91, 22.98) = 19.61, p < 0.000$, partial $\eta^2 = .620$ (moderate to large effect), and no significant differences in comprehension across time for the control group $F(1.53, 28) = .125, p < 0.830$, partial $\eta^2 = .009$ (small effect). Follow-up tests were conducted to evaluate the pairwise differences among the means for the intervention participants across the three time points. Results yielded significant differences in comprehension from pretest to midyear ($p < .008$) and from midyear to posttest ($p < .008$).

Initial differences on pretest means shown on the in favor of the control group were no longer evident at posttest.

GORT-4 Oral Reading Quotient (ORQ) Univariate analysis of variance was conducted to assess differences in overall oral reading ability between the groups and to determine differences in group mean gain scores. Standardized mean effect sizes were calculated to examine differential effects from pretest to posttest. Effect size was calculated as $M_{exp} - M_{con} / SD_{pooled}$ (Hedges, 1981). An effect size of 0.30 was considered to be educationally relevant and an effect over 0.64 would be classified as strong (Halvorsen, 1994). Although a statistically significant differences was observed at pretest in favor of the control classroom, this difference was not observed at posttest, $F(1, 27) = 1.06, p < .312$. Significant and robust growth (pre-test scores minus posttest scores) was observed in favor of the intervention, $F(1, 27) = 10.75, p < .003, g = 1.21$ (strong effect). Notable changes were observed for the intervention participants from pretest ($M = 55.69, SD = 4.92$) to posttest ($M = 65.61, SD = 8.49$) in contrast to the control condition pretest ($M = 68.4, SD = 5.53$) to posttest ($M = 69.2, SD = 9.71$), displayed in Fig. (1). Means, standard deviations, and effect sizes for all measures are presented in Table 2.

DISCUSSION AND CONCLUSION

In this study we examined the effects of a collaborative, multi-component reading intervention on the reading abilities of high school students with severe reading disabilities. Instruction was implemented for 24 weeks, five times per week, for 60 minutes in a differentiated, strategic manner that responded to the reading levels and pre-determined skill needs of the students in the intervention classrooms. Of particular interest were whether meaningful gains could be made in word reading (i.e., decoding), oral reading fluency, vocabulary, and reading comprehension for students given the systematic design of the program, and if growth would be significantly different than students receiving whole classroom instruction.

Impact of Intervention

The main finding was that students in the multi-component intervention program, on average, experienced greater gains in reading skills when compared to students in the traditionally taught whole-class reading program. Even though all pretest means for the measures fell below the controls, significant differences with medium effects were evident for the intervention group on the TOWRE and GORT-4 Comprehension subtest. Overall, meaningful progress was demonstrated in intervention participants' ability to decode words efficiently and in reading comprehension. Significant increases in word reading were observed in the first half of the school year. Significant gains were also noted for the control group in the first half of the year in decoding, but not in the second half. This increase did not impact the control students' reading comprehension. In fact, pretest differences in comprehension favoring the control classroom were not evident at the end of the intervention. Using the GORT-4 Comprehension subtest, we were able to translate differences in overall reading ability into the following average grade equivalents gains after 24 weeks of instruction: intervention = 3.2 grade level gain in

contrast to a 0.1 grade level gain for the control. Although we acknowledge grade equivalent scores need to be interpreted with caution, this is a contextual way to qualify the amount of growth observed for the intervention group. These results corroborate findings obtained by (Berkeley *et al.*, 2011), (Calhoun, 2005), (Swanson 1999), and (Lovett *et al.*, 2000) by demonstrating the effectiveness of combining comprehension instruction with the addition of additional components (i.e., word study, vocabulary, oral reading fluency) for students with significant reading challenges.

Results indicate that there was no significant growth in vocabulary for either condition despite the quantity of vocabulary exposure over the 24 weeks. This result is not surprising. (Roberts *et al.*, 2008) report that gains from vocabulary interventions do not appear to generalize even though significant gains are demonstrated on specific words targeted. An assessment of specific words targeted in the current study is beyond the scope of this study and was not developed.

The second finding was that the collaborative intervention model of delivering support ranged from moderately to very successful for students in the high school grades. Validation for this statement is based on aforementioned standardized test growth and documented changes in comprehension skills in the intervention classroom. Although none of the students achieved grade level reading skills in either group, 10 of the 13 intervention participants demonstrated consistent and ongoing progress. In fact, the intervention participants standardized score gain on the GORT-4 ORQ averaged a standard score gain of 9.92 (range = 3 to 21) in comparison to the control average of 0.8 (range = -15 to 12). A strong, robust effect size ($ES = 1.30$) was demonstrated. Further supportive evidence is based on descriptive analyses of individual student outcomes. The student's with the highest GORT ORQ gains in the intervention group demonstrated the following increases in each reading component: (a) word reading (i.e., $SS = 59$ /posttest $SS = 67$), (b) oral reading fluency (i.e., pretest $SS = 1$ /posttest $SS = 3$), and (c) comprehension (i.e., pretest $SS = 3$ /posttest $SS = 8$). This is in contrast to the highest performing control student's gains: (a) word reading (i.e., pretest $SS = 68$ /posttest $SS = 75$), oral reading fluency (i.e., pretest $SS = 2$ /posttest $SS = 3$), and comprehension (i.e., pretest $SS = 5$ /posttest $SS = 8$). Control student 2 demonstrated the following gains: (a) word reading (i.e., pretest $SS = 81$ /posttest $SS = 80$), (b) oral reading fluency (i.e., pretest $SS = 7$ /posttest $SS = 7$), and (c) comprehension (i.e., pretest $SS = 5$ /posttest $SS = 9$). The majority of the intervention participants increased their reading abilities when compared to the control. In fact, six control participants made minimal progress and would qualify as "non-responders" (Al Otiaba & Fuchs, 2002) based on their posttest ORQ.

Unfortunately, three students in the intervention sample were also determined to be "nonresponders" based on minimal growth in word reading (i.e., Student 1: pretest $SS = 1$ /posttest $SS = 1$; Student 2: pretest $SS = 1$ /posttest $SS = 1$; Student 3: pretest $SS = 1$ /posttest $SS = 1$) and minimal gains in comprehension (i.e., Student 1: pretest $SS = 4$ /posttest $SS = 5$; Student 2: pretest $SS = 4$ /posttest $SS = 5$; Student 3: pretest $SS = 2$ /posttest $SS = 4$). The pretest/posttest ORQ for

each student was rated as “Very Poor” (i.e., Student 1 SS = 53/58, Student 2 SS = 52/55, and Student 3SS = 52/55). Overall, their growth fell significantly below the other students in the intervention. As noted by Roberts *et al.* (2008), “For older students with LD who continue to struggle in reading, the challenge is providing instruction that is powerful enough to narrow or close the gap with grade-level standards in reading”. It is obvious that these students needed additional support and intervention time beyond the multi-component intervention programming received in the intervention classroom.

Implications for Practice

Based on the standardized test growth and documented changes in comprehension skills in the intervention classroom, it appears that the collaborative model of delivering intervention was successful for nine out of the twelve students with severe reading disabilities. Although unable to distinguish which instructional model was the most effective (i.e., collaborative learning (Swanson, 1999), CWPT (Greenwood *et al.*, 2007), direct, explicit, and intensive instruction (Carnine *et al.*, 2006; Foorman & Torgesen, 2001), small group instruction (Elbaum *et al.*, 1999), positive emotional support, and repeated practice (Lovett *et al.*, 2000; Rashotte *et al.*, 2001), we can say with some degree of certainty that increased opportunities to respond, engagement in cooperative groups, and the opportunity to practice skills to mastery led to the positive outcomes on standardized tests and to documented changes in reading skills of high school students with severe reading disabilities. These findings also validate the notion that teachers must use the most robust pedagogical components in order to begin to close the gap that exists between older readers who struggle with reading and good readers (Cirino *et al.*, 2013; Faggella-Luby & Deshler, 2008; Roberts *et al.*, 2008; Vaughn & Fletcher, 2012).

Another reason for the effectiveness of the program may be attributed to the manner in which individual learning needs were addressed (Vaughn & Fletcher, 2012). Specifically, intervention was delivered in differentiated small group, center-based, multi-dimensional formats over the course of the school year rather than in whole classroom combined with traditional, special educational supports that last for short durations of time (Lovett *et al.*, 2000). Progress was monitored and instructional changes were made based on information garnered from the data. In the current study, students received inclusive, differentiated instruction delivered in small groups for 60 minutes a day, 5 times per week, for 24 weeks (i.e., 12 weeks September to December, 12 weeks January to May) for a total of 7200 minutes or 120 hours. (Torgesen, 2000) indicated that gains made with the lowest performing students can be attributed in part to the intensity of learning and to the number of hours the intervention lasts.

One final promising characteristic of this study lies in contrast to other research for adolescent students with reading disabilities (Berkeley *et al.*, 2011; Calhoon *et al.*, 2010). In the current study, we utilized school personnel to implement this intervention rather than graduate assistants or researchers. The special educators, speech language

pathologists, and paraprofessionals maximized their effectiveness after restructuring their daily schedule in order to provide intervention that was systematic and individualized. It is hypothesized that the moderate to large effects were gained on reading skills will positively impact students as they move into post-secondary career and college choices.

LIMITATIONS

Examination of experimental student’s responses to the intervention provides preliminary information related to student outcome, but caution should be exercised when generalizing results to other students secondary to the small sample size. Another limitation is that, despite randomization, groups with unequal sizes were enrolled across experimental and control groups. In addition, no follow up or maintenance data was collected to determine if these gains sustain past the intervention year. Similarly, after the intervention was complete, the researchers no longer sustained classroom supports for data driven, differentiated inclusive instruction. A significant limitation was the inability to maintain professional development and supports to intervention schools. Finally, the authors note that they can only hypothesize about how motivating the inclusive intervention was for students based on student interviews. No measurement of student motivation was administered.

FUTURE RESEARCH

In light of our findings and study limitations, future research should produce replications of this research with secondary students with severe reading disabilities in and middle school to determine if the embedded intervention programming delivered in an inclusive format garners similar effects in this population. Similarly, there is a need for investigations that address the individualized needs of older students with challenges in reading who have not responded to effective early classroom instruction and evaluate how instructional methods impact learning.

Despite the small sample size, this study provides evidence of the benefits of a collaborative, multi-component reading intervention that included center-based, differentiated instruction to promote reading growth for students in high school with severe reading disabilities. In the experimental condition, students received explicit/direct teaching, small group instruction, and numerous opportunities to respond and practice skills and subsequently made significant gains related to accuracy and fluency with connected text and reading comprehension. The findings from this study are in line with that of other research that demonstrates it is possible for students who have spent years struggling learning how to read to make gains in reading ability. In addition, this intervention demonstrates that general education teachers, special education teachers and support personnel can work collaboratively and efficiently to effectively embed strategic, individualized interventions within a classroom setting.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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