


Improving Reading Comprehension for High School Students With Disabilities: Effects for Comprehension and School Retention

Exceptional Children
2015, Vol. 82(1) 117–131
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DOI: 10.1177/0014402915585478
ec.sagepub.com


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Abstract

The authors examine the results for students with disabilities from a 2-year randomized controlled trial with students identified in ninth grade and followed through 10th grade in their allotted condition group. Prior to ninth grade, students with disabilities who met criteria for low reading comprehension (i.e., through failure on the state accountability test) were randomly assigned to one of three treatment conditions—reading without dropout prevention, reading with dropout prevention, dropout prevention without reading—or a business-as-usual condition. Students with disabilities in the reading treatments demonstrated significant gains on reading comprehension (Hedges's $g = .44$) compared to students with disabilities in the business-as-usual and dropout-prevention-without-reading conditions. Results support extensive (2-year) interventions in reading for high school students with disabilities.

Reading comprehension problems are pervasive and associated with considerable challenges in learning from text, accessing print-related information related to daily functioning (including interpreting information online), and achieving job success (Reschly, 2010). Results from the 2011 National Assessment of Educational Progress indicate that over 65% of fourth and eighth graders read below a proficient level (National Center for Education Statistics, 2011). One third of fourth graders and nearly one fourth of eighth graders scored below basic in reading, meaning that they inadequately comprehend text written at their grade level. These data support what teachers experience every day. Substantial numbers of students after third grade do not read text sufficiently well to understand and learn, which negatively influences their success and interest in school.

Over the past 20 years, considerable research has focused on beginning reading,

with the expectation that if educators better understood how students learn to read, the field of education would make significant strides in solving the reading problem. Numerous experimental and quasi-experimental studies have been conducted with struggling readers, primarily in the early elementary grades, improving the knowledge base about the critical components of effective reading intervention, the role of various cognitive processes in reading, and the extent to which instructional practices in reading (e.g., feedback) are associated with improved outcomes

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(Coyne, Kame'enui, Simmons, & Harn, 2004; Foorman et al., 1997; Hattie & Timperley, 2007; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001; Torgesen et al., 2001; Wanzek & Vaughn, 2008). Although there is a growing knowledge base about how students acquire beginning reading skills and procedures for remedying early reading problems, improving students' reading comprehension is persistent problem, particularly as the text and content demands become increasingly challenging.

Reading Disabilities With Secondary Students

There is considerable evidence that remediating reading difficulties after Grade 3 is particularly challenging. In fact, as students move through the grades, the effect of reading interventions on reading outcomes declines (Lipsey et al., 2012; Scammacca, Roberts, Vaughn, & Stuebing, 2013). To illustrate this point, the mean effect sizes (MESs) for reading outcomes across nationally normed tests are 1.52 in kindergarten and first grade, 0.40 in fourth and fifth grades, and 0.19 by ninth and 10th grades (Hill, Bloom, Black, & Lipsey, 2008). In a meta-analysis of reading interventions for students with reading difficulties, outcomes in elementary were more than twice those of students in secondary grades (Wanzek et al., 2013; Wanzek & Vaughn, 2007). For standardized tests with broad scope (e.g., standardized reading comprehension measures), the mean effects at middle school are 0.15 and are not available at high school (Lipsey et al., 2012). All of these data support the view that remediating reading difficulties in older students is a challenging enterprise (Kamil et al., 2008). For example, Wanzek, Wexler, Vaughn, and Ciullo (2010) reported an MES of 0.20 (22 effects) for word reading as the largest effect for extensive intervention targeting students with reading difficulties in Grades 4 to 12; for studies with students with reading difficulties in kindergarten to third grade, the MES for word reading from extensive interventions was .56 (53 effects). Reading comprehension outcomes for students in Grades 4 to 12 yielded a small MES

of 0.09 (37 effects), whereas for students in kindergarten through third grade, the MES was five times as large (0.46; 25 effects). In summary, data suggest that early interventions are necessary but not sufficient to resolve reading difficulties and that remediation efforts with students beyond third grade are likely to require more extensive and intensive interventions.

In one of the few experimental studies conducted at the high school level aimed at remediating reading difficulties (Lang et al., 2009), the authors reported a lack of statistically significant differences among the interventions provided to high-risk ninth-grade students when compared with a business-as-usual (BAU) group. The authors stated that "most students who enter high school reading substantially below grade level will require more than 1 year of relatively intensive reading intervention" (p. 22). Nonetheless, there is relatively little experimental research with high school students with reading difficulties; in a recent synthesis, the authors reported that they were unable to locate a single reading intervention experimental study conducted with 10th-, 11th-, or 12th-grade students (Wanzek et al., 2013).

As reported in the study of ninth-grade students (Lang et al., 2009), secondary students who have struggled to read for many years are likely to require more extensive reading interventions to make up for the reduced orthographic exposures to print associated with limited reading experience, as well as to enhance their vocabulary and background knowledge so that comprehension of complex texts is possible (Compton, Miller, Elleman, & Steacy, 2014).

To evaluate the effects of a series of interventions with secondary students with reading disabilities, Vaughn, Wexler, et al. (2011) conducted a 3-year reading intervention with sixth-grade students. Using a response-to-intervention framework, students with reading disabilities were randomly assigned to treatment and comparison conditions. Those who responded inadequately to treatment were provided with interventions the subsequent year. Treatment effect was based on growth among students who did not meet exit criteria (e.g., continued low reading comprehension) compared to those in the BAU group,

who also did not meet exit criteria. When this group of persistently low readers (i.e., the subgroup of treatment students who received all 3 years of the intensive reading program) was compared to similar BAU students on the Gates–MacGinitie Reading Comprehension subtest (MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2000), the effects (Hedges $g = 1.20$) were large (Vaughn, Wexler, et al., 2011). Treated students made expected (or normative) progress over the 3 years compared to the BAU students, who lost ground to the treatment students as well as to normative reading trends. This “normative” progress for treated students is impressive because students who were enrolled in the treatment were significantly behind typical peers. Although data about these students’ progress in school (e.g., grades) were not reported, it is conceivable that their reading comprehension progress allowed them to more effectively function in content classrooms. The findings (Vaughn, Wexler, et al., 2011) suggest that secondary students with significant reading difficulties may require an extensive intervention (e.g., over several years). Regarding the subgroup of students with disabilities from this study, middle school students with learning disabilities who received treatment demonstrated improved word reading both at posttest and at a 4-month follow-up (Wanzek, Vaughn, Roberts, & Fletcher, 2011).

Overall small effect sizes have been reported from experimental studies examining the effect of extensive treatments provided to secondary students (i.e., Grade 6 or higher) with reading difficulties. For example, Chamberlain, Daniels, Madden, and Slavin (2007) reported no statistically significant differences on the Gates–MacGinitie Reading Comprehension subtest in a sample of sixth graders after a year-long implementation of Reading Edge. An evaluation of Enhanced Reading Opportunities found no statistically significant differences between two treatment groups and a BAU condition on oral language- and vocabulary-related outcomes, and it found very small differences on a measure of reading comprehension (Somers et al., 2010). Small to moderate effects were also reported for reading comprehension in a sample of sixth to eighth

graders provided with daily intensive instruction during an entire school year (Vaughn et al., 2014).

Content-Area Reading

The Common Core State Standards (CCSS; National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010) require students to read increasingly difficult texts to build domain-specific knowledge (i.e., acquire content knowledge) and to develop and defend diverse perspectives as a means of becoming content-area literate. The expectation is that high-achieving secondary school students will thrive in response to the more challenging standards, whereas students with reading difficulties will require extensive supports to meet these text-based demands. A hallmark of the CCSS for students above third grade is building content-area literacy through increasingly challenging texts. Still, there are few specifications for how to meet the needs of students with reading disabilities exposed to these increasingly challenging texts that they are unable to read. Our research-to-practice interests focus on students who continue to struggle with reading in secondary school and their prospects for being successful in content-area classes when provided with long-term, intensive reading intervention within the texts and topics of social studies (e.g., world history) and science (e.g., biology).

To improve their reading comprehension, secondary students with reading difficulties need opportunities to acquire the disciplinary literacy of the content areas, particularly social studies and science (Shanahan & Shanahan, 2008). Disciplinary literacy requires understanding the vocabulary and the ways of learning from text that are specific to the content—whether it is mathematical, historical, or scientific—and it often requires students to focus more on features of text than on instructional strategies. For example, an intervention for struggling middle school readers that used close reading of text (e.g., short complex text repeatedly read with text-dependent questions) had positive outcomes on reading comprehension (Fisher & Frey, 2014). Horton,

Lovitt, and Christensen (1991) manipulated the amount of referential support provided in study guides that often accompany science and social studies textbooks. They adapted three study guides from a ninth-grade science textbook and a ninth-grade social studies textbook, differing on levels of cuing. The highest level presented the study questions; the medium level presented the questions, along with the page and paragraph numbers necessary to locate relevant details; and the lowest level presented questions, page numbers, as well as several salient details for composing a response. The guides were used in three instructional settings: teacher-directed study, dyadic study, and independent study. The multilevel guides were more effective than the single-level guides for both textbooks when dealing with factual questions and when implemented in the teacher-directed instructional setting. On interpretive (or inferential) question types, the multilevel guides were more efficacious than the single-level guides when used with social studies textbooks, and they were comparably effective across the three instructional settings. In science, the type of study guide and the instructional setting were not related to performance on interpretive questions.

The current study provides a reading intervention that is integrated into the disciplinary knowledge of social studies and science necessary for success in content-area classrooms. Recognizing that intervention effects for secondary and adult struggling readers are difficult to obtain (Calhoon, Scarborough, & Miller, 2013), we provided a 2-year intervention that used texts and key vocabulary aligned with the social studies and science units taught in those grade levels. This study reports findings for students with disabilities participating in a large-scale multiyear intervention study (Roberts, Vaughn, Fletcher, Stuebing, & Barth, 2013; Vaughn et al., 2014).

Reading and Dropout With Secondary Students

Students who struggle academically are more likely to drop out of school (Allensworth &

Easton, 2005; Christle, Jolviette, & Nelson, 2007; Dynarski et al., 2008). In fact, course failure and school retention are factors that have been associated with an increased likelihood of dropping out (Goldschmidt & Wang, 1999; Lee & Burkam, 2003; Rumberger, 1995; Rumberger & Larson, 1998; Rumberger & Palardy, 2005). A major cause of school failure and retention stems from an inability to read proficiently; consequently, poor reading performance is one of the strongest predictors of school dropout (Balfanz, Bridgeland, Moore, & Fox, 2010; Hernandez, 2012). Results from a recently published report of a longitudinal study of nearly 4,000 students showed that an inability to read proficiently by the end of third grade increases the likelihood students will not graduate on time. Further, for students who live in poverty and who do not read proficiently there is even more of a chance that they will not graduate on time, if at all (Hernandez, 2012).

Despite the importance of effective reading, many struggling readers never receive the intervention needed to close the gap with their typically developing peers, leading them to continue to struggle in the secondary grades (Vaughn et al., 2014). The negative cycle that occurs for most poor readers includes disengagement and withdrawal from school, leading to school dropout (Allensworth & Easton, 2005; Balfanz, Herzog, & MacIver, 2007; Fall & Roberts, 2012; Glennie, Bonneau, Vandellen, & Dodge, 2012; Rumberger & Lim, 2008). The issue of school dropout therefore goes hand in hand with the issue of improving the reading performance of secondary struggling readers.

Design and Research Questions

The CCSS provide high goals for comprehension within content-area texts for all students, including those with reading difficulties. Ideally, reading interventions would be unnecessary after the elementary grades; however, an increasing number of students require reading interventions into adolescence and adulthood (Miller,

McCardle, & Hernandez, 2010). Even though the overall study will continue to follow all students through 12th grade, we report findings for students with disabilities at the end of 10th grade, when the 2-year reading treatment was terminated. We addressed the following primary research question: To what extent does the reading intervention improve the reading comprehension of ninth and 10th graders with disabilities? The secondary question was whether students with disabilities in the treatment condition would remain in school at higher rates than those of students with disabilities in the comparison condition. To address the secondary question, we report school enrollment data for students at the end of Grade 11, 1 year after the 2-year intervention.

Findings for students with disabilities from the 2-year randomized control trial are reported in this article. These students with disabilities are a subsample of the overall at-risk participant group (Vaughn et al., 2014). All qualified students (e.g., students at risk due to low achievement) were randomly assigned to condition within schools. Interventions were provided to students during their ninth- and 10th-grade years (2010–2012). Follow-up measures of cognitive and behavioral outcomes will be collected during students' 11th- and 12th-grade years.

Method

Participants

School sites. Three diverse high schools in a large urban Southwestern U.S. district participated in the study, with approximately a third of the sample from each site. In the sampled schools, approximately 43% of the students were Hispanic; 25.51%, White; 19.44%, African American; 7.85%, Asian; and 4.06%, Native American or biracial. In addition, 42.6% of students in participating schools were economically disadvantaged. Approximately 8% of the schools' population qualified for special education services. Based on the state's evaluation system, the schools were rated as *academically acceptable* for the 2011–2012 school year.

Participant selection. All eighth-grade students from the five middle schools feeding into the three participating high schools were screened according to seventh-grade scores from the state reading test—the Texas Assessment of Knowledge and Skills (TAKS; Texas Education Agency, 2004). The district requested that randomization and class scheduling occur during the spring semester of 2009, prior to beginning the intervention in the fall semester of 2010. The seventh-grade TAKS scores were the most current data available at that time. The TAKS is considered a reliable and valid measure to screen for reading difficulties, and it has been used in previous studies to identify students with reading comprehension difficulties (Vaughn & Fletcher, 2012). The failing score is 2100 or below, and the standard error of measurement is 100. Students qualified for the study if they scored 2200 or below on the first TAKS administration. Students in the 2100–2200 score range were included because their observed scores were within the lower bound of the 95% confidence interval, indicating that their true score could be less than 2100. In addition, students with missing scores on the reading portion of the TAKS qualified for the study if they failed a core class (English language arts, social studies, science, or math) during seventh grade or the first semester of eighth grade and if they met at least one of the risk indicators for dropping out of school: behavior, attendance, retention, or tardies. The overall sample for the study has been reported (Vaughn et al., 2014), and we report here participant description for students with disabilities.

The sample of students with disabilities at the beginning of the intervention included 77 students (Table 1). Of these 77 students, all but three were classified as having learning disabilities; the other three were identified as having behavior disorders. Based on the demographics of the entire sample, the majority of participants were male (66.2%, $n = 51$). Students were identified as Hispanic (45.5%, $n = 35$), White (23.4%, $n = 18$), African American (27.3%, $n = 21$), and Asian (3.9%, $n = 3$).

Table 1. Student Participant Descriptive Information.

	Comparison		Intervention	
	<i>n</i>	%	<i>n</i>	%
Gender				
Male	20	58.8	31	72.1
Female	14	41.2	12	27.9
Ethnicity				
White	9	26.5	9	20.9
African American	7	20.6	14	32.6
Hispanic	16	47.1	19	44.2
Asian	2	5.9	1	2.3
English language learners	9	26.5	11	25.6

Reading Intervention

Students in the reading intervention participated in classes of no more than 10 students during their elective period. The research team hired and trained two teachers to provide reading intervention during these classes. Students participated in the 50-min classes daily for approximately 160 school days, or about 320 sessions, over the 2-year treatment. All students with disabilities continued to receive the special education services specified in their individualized education program whether they were assigned to the treatment or comparison condition. The treatment protocol focused on four areas: word study, vocabulary in content-area text, comprehension of content-area text, and engagement (Vaughn et al., 2014).

The instruction was divided into two phases. In Phase I, during the first semester of the first project year, students were explicitly taught an advanced word study strategy through the REWARDS Plus program (Archer, Gleason, & Vachon, 2005). Students learned to identify affixes, vowels, and vowel combinations and their corresponding sounds for the purpose of segmenting multisyllabic words into decodable chunks. Six to eight vocabulary words were identified weekly from the expository textbooks used in students’ science and social studies classes and introduced by using an explicit evidence-based six-step process (Vaughn Gross Center for Reading and Language Arts at The

University of Texas at Austin, 2010). This process included a picture or brief video, a student-friendly description of the key word, and an opportunity to extend word meaning through related words and connect the word to content learning. Following explicit introduction, word knowledge was reinforced through daily deep-processing activities and exposure in text. During Phase 1 students were also introduced to a multistep comprehension strategy based on collaborative strategic reading (Vaughn, Klingner, et al., 2011; Vaughn, Wexler, et al., 2011) in which they received explicit modeling and scaffolded support for each strategy, time for individual practice of each strategy, and support in applying and synthesizing the collective strategies while reading texts related to the content-area instruction in social studies and science.

Phase 2 began in the second semester of the second project year, and ongoing support was provided to students, requiring additional word-level work or practice with the comprehension strategies. Instruction was organized into 6- to 8-day instructional units, focusing on texts from students’ content-area classes. Within each unit, word study strategies were applied to unfamiliar and multisyllabic words, and students were introduced to additional affixes according to the target passage and the impact of each affix on parts of speech and on word meaning. Vocabulary was explicitly taught and reinforced with daily deep-processing activities. Application of the multistep comprehension strategy was managed within each unit

by using the standardized six-step summary-writing strategy taught to students in Phase 1 (Brown & Day, 1983; Cordero-Ponce, 2000; Klingner, Morrison, & Eppolito, 2011), and each instructional unit contained an explicit discussion task and protocol aimed at deepening students' understanding of the text's meaning through critical analysis and problem solving (Kamil et al., 2008).

Student engagement was addressed in several ways. The alignment of selected passages with topics in students' social studies and science classes proved motivating for a number of students. Students had specific content learning goals for each unit (Boardman et al., 2008). Also, for each unit, students were given a set of three specific relevance instructions for identifying key content of a reading passage (McCruden, Magliano, & Schraw, 2010). Teachers used these instructions during passage reading to check for student understanding. Student-developed questions were also included. Finally, 10 min of student free-choice silent reading was incorporated into each instructional day. During this free-choice reading time, students could select from numerous text sources in the classroom or library. During this time, the reading interventionist counseled different students regarding their free-choice text, and within each unit, students were given an opportunity to share a summary of their most recently read free-choice text with a selected peer.

Comparison condition. All students in both conditions continued to receive the special education services specified in their individualized education programs. The research team conducting the study did not have access to this information; however, they did observe student support from special education teachers for homework assignments, tests, and other school-related tasks to enhance their achievement in the general education classroom. These services were not differentially provided to students in the treatment or comparison condition. During their elective period, students in the treatment condition were provided with the reading instruction, whereas students in the comparison condition remained in their

elective classes, which included subjects such as music, band, art, and cooking classes.

Reading Intervention Teachers

Research staff members hired, trained, and supported reading intervention teachers. All interventionists were certified teachers with experience teaching students with disabilities or struggling readers. They participated in a weeklong professional development sequence prior to implementing the intervention that focused on the study design, general features of effective instruction, expectations related to human subjects research, and details on the expectations related to adhering to and measuring implementation fidelity. Effective intervention was modeled, and participants had opportunities to practice and receive constructive feedback on the match between their practice and the normative program model. Peer groups were established, and pairs of participants were encouraged to review and comment on samples of their partners' instructional practice. A research staff member provided regular coaching to interventionists during the training and then throughout implementation.

Students' progress-monitoring data (fluency using words correct per minute and maze tasks) were collected once a week and used as a means of determining treatment effectiveness and students' response to instruction. Interventionists in classes with poorly performing students were the priority for coaching. Quarterly half-day "booster" sessions were provided to interventionists, and abbreviated training (2.5 days) was provided prior to beginning Year 2 of the project.

Measures

Implementation fidelity. Fidelity data were collected throughout both years of implementation. Each interventionist was observed six times a year by a member of the research team trained on the intervention elements and on features of its effective implementation. Ratings were calibrated twice annually during a joint observation with the project director; interrater reliability on these occasions was

Table 2. Mean Fidelity Score for Observed Variables by Year.

Observed Component	Year 1	Year 2
Vocabulary ^a	3.4	3.6
Comprehension ^a	3.4	3.5
Discussion ^a	3.2	3.3
Motivation ^a	2.8	3.6
Student engagement ^a	3.4	3.8
Global classroom management ^b	5.7	6.7
Global classroom instruction ^b	6.0	5.5
Average total fidelity ^b	84%	90%

^aScores rated on 4-point Likert-type scale, with 4 as highest score.

^bScores rated on 7-point Likert-type scale, with 7 as highest score.

greater than 90%. The fidelity observation tool was based on the program’s theory of change and was designed to capture critical instructional elements. Motivation was included as part of the fidelity routine, given its importance for engaging adolescent students in meaningful discussion and interpretation of text (Kamil et al., 2008; Roberts, Torgesen, Boardman, & Scammacca, 2008). A measure of student engagement was administered at 15-min intervals during observed intervention sessions. Specific criteria for student engagement (e.g., on task) were used to determine students’ levels of motivation and engagement. An overall quality of interventionists’ classroom management and instruction was also assigned at each observation’s conclusion. The Likert-type items on the fidelity protocol were scored from 1 to 4, with 4 representing a component that was implemented with high fidelity and 1 indicating a component that was not implemented. Student engagement was measured on a Likert-type scale ranging from 4 (*≥90% engaged*) to 1 (*<12% engaged*). The global quality of classroom management and instruction was measured with 7-point scales, with 6 and 7 indicating high quality and 1 and 2 indicating low quality. Fidelity was calculated as the proportion of assigned points to total possible points. Interventionists’ average fidelity ranged from 78% to 87% in Year 1 and 84% to 92% in Year 2. Table 2 presents mean scores for each measured component.

Gates–MacGinitie Reading Tests. The Gates–MacGinitie Reading Tests (MacGinitie et al., 2000) are group administered, norm referenced, and appropriate for kindergarten students to adults. We administered the Reading Comprehension subtest, which includes expository and narrative reading passages, followed by questions with multiple-choice answers. Questions in the passages address facts, inferencing, and drawing conclusions. Internal-consistency reliability ranges from .91 to .93, and alternate-form reliability is reported as .80 to .87. The Gates–MacGinitie Reading Tests are well normed and frequently used in research studies with secondary students.

School enrollment data. We followed students’ school enrollment status until the end of 11th grade, 1 year after the 2-year intervention (ninth and 10th grades). We tracked students through social media, interviews with friends, and school data sources. Table 3 provides a summary of school enrollment status of all treatment and comparison students with disabilities in this study.

Results

Means and standard deviations for the pretest and posttest Gates–MacGinitie Reading Comprehension subtest (standard scores and extended scale scores) are summarized in Table 4 for the sample of students with disabilities. We confirmed that the effect of dropout prevention did

Table 3. Student Enrollment Status at the End of 11th Grade.

	Comparison		Treatment	
	%	<i>n</i>	%	<i>n</i>
Enrolled	79.4	27	88.4	38
Homeschooled	2.9	1	2.3	1
Enrolled in another public school in Texas	2.9	1	7.0	3
No enrollment information (potential dropout)	5.9	2	0.0	0
Summer withdrawal (potential dropout)	2.9	1	2.3	1
Returned to home country	2.9	1	0.0	0
Enrolled outside Texas	2.9	1	0.0	0

Table 4. Pretest and Posttest Data for the Gates–MacGinitie Reading Comprehension Subtest.

	Pretest			Posttest		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Extended scale score						
Comparison	504.66	33.73	435–590	528.60	21.57	473–573
Intervention	492.29	27.85	410–543	533.55	15.52	507–576
Standard score						
Comparison	84.24	13.09	65–117	87.98	9.60	65–106
Intervention	79.76	9.51	65–99	90.25	6.87	77–107

not differ in the sample of students with disabilities assigned to reading treatment (R + DO) and the sample not assigned to reading treatment (DO only). This finding supported use of the R + DO and R-only groups to estimate treatment effects of reading intervention and the use of the DO-only and BAU groups as the comparison.

We used analysis of covariance to compare students in the treatment group (R-only group or R + DO group) and students in the comparison group (DO-only group or BAU group). Assumptions regarding homogeneity of regression were met ($p = .79$). Hedges's g effect size for small samples was computed as the covariate-adjusted mean difference divided by the unadjusted pooled within-group standard deviation (What Works Clearinghouse, 2013). On the basis of extended scale scores, there were no statistically significant pretest differences between students in the treatment and comparison groups, suggesting pretreatment equivalence on the Gates–MacGinitie ($\beta = -12.37$, $SE = 7.42$, $p = .10$). As shown in Figure 1, students with disabilities in the treatment group scored significantly higher

than students in the comparison group on the Gates–MacGinitie Reading Comprehension subtest ($\beta = 8.21$, $SE = .07$, $p = .05$). The Hedges's g effect size was 0.44.

We report school enrollment status for students with disabilities in the treatment and comparison conditions at the end of 11th grade (see Table 3). The data indicate that 88% of students with disabilities in the treatment condition were enrolled in school at the end of 11th grade, whereas 79% of students in the comparison condition were enrolled in school. Although the difference is not statistically significant, $\chi^2(1) = 1.16$, $p = .28$, it suggests a promising association between students in reading treatment and school enrollment.

Discussion

In this study, a 2-year reading intervention was provided to students with identified disabilities who also demonstrated reading comprehension problems. The intervention was provided during their ninth- and 10th-grade years. Students with

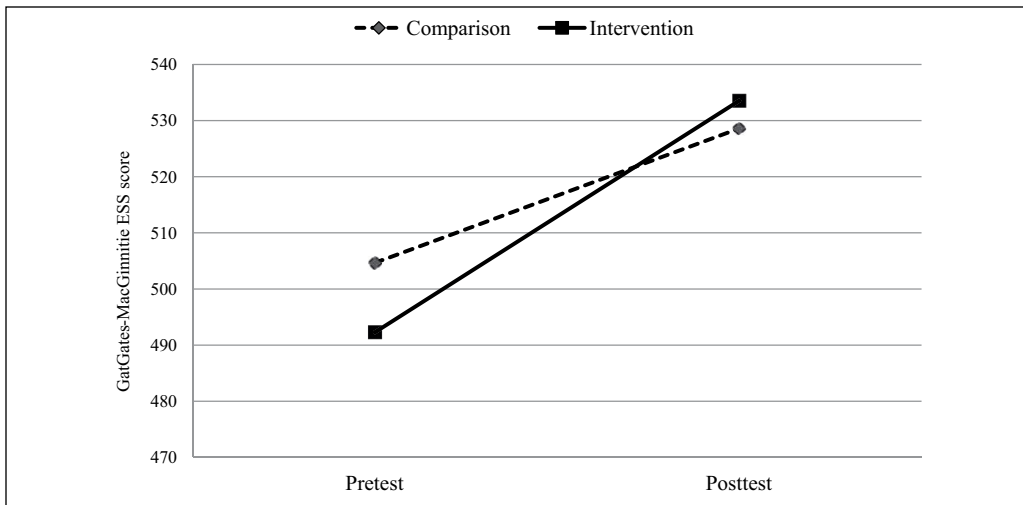


Figure 1. Pretest and posttest mean extended scale scores on the Gates–MacGinitie Reading Comprehension subtest for the intervention and comparison groups.

disabilities in the treatment group scored significantly higher on a standardized measure of reading comprehension than did students with disabilities in the nonreading condition ($ES = 0.44$). This study is one of the few experimental studies for students with disabilities in high school and the only known experimental study providing a 2-year treatment with this age group. The effect size of nearly half a standard deviation could be considered in the very high range, compared with other studies with secondary students with average effect sizes <0.20 (Wanzek et al., 2013).

Although it may be tempting to think that the overall “long” intervention (2 school years) should yield a higher impact than a briefer intervention, research has consistently shown that intervention effects are typically quite robust for brief interventions (e.g., ≤ 8 weeks). It may be that longer interventions lose their effect over time, potentially as a result of novelty, reduced student or teacher engagement, or tapering of teacher fidelity. Of course, larger findings in brief interventions may also be explained by the more extensive reliance on researcher-developed proximal measures used in many intervention studies (Scammacca et al., 2013).

The practical meaning of an effect size can be interpreted in terms of the expected growth over time. Hill et al. (2008) estimated the

average annual progress in reading for ninth, 10th, and 11th graders at about 0.19, which represents the standardized within-student change from one spring to the next spring in the normative samples used by a number of standardized reading measures. The authors based their estimates of annual gain on the group of students at the 50th percentile. In a randomized design, the comparison group represents outcomes that would be likely in the absence of treatment, and an effect size can be calculated as the difference in the posttest scores for the treated and untreated groups divided by estimated groupwise variation. A between-students effect of 0.44 represents a difference of about 44% of the sample's standard deviation. Note that this effect is over and above the 0.19 change described by Hill et al. because students in both groups (comparison and treatment) are likely to make similar gains (i.e., independent of their exposure to the intervention). The Hill et al. benchmarks provide a context for characterizing the treatment effect. In this case, if one assumes that the Hill values are additive, the within-student change over 2 years is 0.38. The treatment effect of 0.44 represents more than twice the change in reading scores that is expected in the group of average students from ninth through 10th grade, suggesting that students

in the reading treatment improved 100% more than they might have otherwise. Because the students in our sample were students with disabilities, they are not likely to be at the 50th percentile, on average. To the extent that their expected change over 2 years is <0.19 , an effect size of 0.44 represents an even greater change over that which would be otherwise expected. Further, the effect size for students with disabilities is almost exactly the same as that for the broader sample of students with reading difficulties ($ES = 0.43$; Vaughn et al., 2014). Hill et al. (2008) urged caution in using these benchmarked values: Different measures are involved, and the variance in intervention samples and normative samples may or may not be comparable. We echo the recommendation that these be used conservatively. That said, we also agree with Hill et al. that effect size estimates often suffer from a lack of context and, when used properly, benchmarks of within-student annual growth offer a useful frame for considering the practical significance of a treatment's effect.

Hill et al. (2008) also suggested that one consider policy implications when interpreting effects. Based on their reported reading data showing a Black–White achievement gap of 0.80 and a Hispanic–White achievement gap of 0.76, the gains in effect size of our primarily minority sample of students with disabilities indicates that the intervention was associated with a 45% reduction in the gap for minority students, suggesting high practical significance.

Hill et al. (2008) also asked that, when interpreting effect sizes, researchers compare effects with those from other intervention studies with the same population. We were unable to locate 2-year reading interventions with ninth and 10th graders with disabilities; however, effects for secondary students with reading difficulties have been substantially lower (e.g., Lang et al., 2009; Scammacca et al., 2013).

A secondary question related to this study was to understand the influence of reading intervention treatment on school enrollment. Findings at the end of 11th grade indicate that students with disabilities who participated in the reading intervention treatment were associated with higher

enrollment in school than were students in the comparison condition, although the difference was not statistically significant. We consider this finding useful for generating future hypotheses about the effects of reading interventions in high school on school enrollment.

Implications

Although the observed improvements in reading comprehension are encouraging, the majority of treated students continued to read at levels well below average, suggesting ongoing challenges with the complex text that they are likely to encounter in high school. We can assume that an improvement of half a standard deviation on their standard score outcomes is associated with meaningful influence on their understanding of complex texts. The results document the effectiveness for students with disabilities of intensive reading intervention provided for extended time in improving both reading skills and access to content in subject areas necessary for success in and graduation from high school. We do not interpret our findings as evidence that struggling readers should be excluded from the raised expectations that accompany the CCSS. This study suggests that interventions aimed at improving complex skills such as reading comprehension are likely to require extensive and ongoing intervention for many students with disabilities to successfully understand high school texts. Two years of intensive reading intervention “moved the needle” for reading comprehension and provided support that high school is not too late to intervene to enhance reading outcomes. Although many would argue that a 2-year reading intervention is extensive, the length of the intervention may be more in line with what is necessary when one considers the significance and pervasiveness of the reading disabilities.

Limitations and Future Research

We were primarily interested in whether high school students with disabilities would benefit from an extensive intervention. For this reason, we provided only a standardized treatment for all students, responding to their

individual learning needs by adjusting pacing, text difficulty, and feedback with additional practice. Questions about whether more individualized approaches to treatment might be associated with even greater effect would be worthwhile.

Because this study took place in a high school setting, we had limited opportunities to test students. We think that it would be valuable to measure students' performance using multiple measures of comprehension.

Also, the research on discipline-related differences in effective reading practices (beyond prior knowledge effects) may have applications for struggling students (Shanahan & Shanahan, 2008). If the CCSS, as expected, provides students with increasingly challenging texts in high school content-area classrooms, then guidelines will be needed outlining how students access these texts successfully.

Finally, the study design can be considered experimental to the extent that students with disabilities were nonsystematically represented in the different conditions. Students with disabilities had equal likelihood of being assigned to any of the four treatment conditions, supporting the study's internal validity. Further, there was no differential attrition across conditions for students with disabilities (Vaughn et al., 2014), supporting the findings' validity. However, when randomizing to conditions, we did not stratify on special education status, nor did we know or stratify on type of disability. This fact represents a threat to the validity of the study to the extent that different types of disability represent different levels of risk or response to intervention and that the treatment groups differed significantly in the mix of disabling conditions.

Conclusion

The CCSS provide expectations for understanding complex text. Consequently, even more emphasis has been placed on confirming effective practices to help secondary struggling learners to read, comprehend, and acquire domain-specific knowledge from complex texts. Previous research with high school students with reading difficulties or disabilities has yielded

very few studies, and they have produced only small effects (Lang et al., 2009; Wanzek et al., 2013). Findings from this 2-year reading treatment with ninth and 10th graders with disabilities is the first multiyear high school experimental study that shows evidence of effectiveness for intensive reading intervention aligned with content from secondary social studies and science expectations. Although we recognize the magnitude of the resources to implement interventions at the high school level, we interpret the findings from the current study to be encouraging in light of the difficulty of making an impact on reading comprehension and content acquisition with secondary learners with disabilities.

Authors' Note

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R324A100022 to The University of Texas at Austin as part of the Preventing School Dropout with Secondary Students: The Implementation of an Individualized Reading Intervention and Dropout Prevention Intervention grant. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

References

- Allensworth, E., & Easton, J. (2005). *The on-track indicator as a predictor of high school graduation*. Chicago, IL: Consortium on Chicago School Research.
- Archer, A. L., Gleason, M. M., & Vachon, V. (2005). *REWARDS plus: Reading strategies applied to social studies passages*. Longmon, CO: Sopris West.
- Balfanz, R., Bridgeland, J. M., Moore, L. A., & Fox, J. H. (2010). *Building a grad nation: Progress and challenge in ending the high school dropout epidemic*. Retrieved from http://www.civicerprises.net/MediaLibrary/Docs/building_a_grad_nation.pdf
- Balfanz, R., Herzog, L., & MacIver, D. J. (2007). Preventing student disengagement and keeping students on the graduation path in urban middle-grades schools: Early identification and effective interventions. *Educational Psychologist*, 42, 223–235.
- Boardman, A. G., Roberts, G., Vaughn, S., Wexler, J., Murray, C. S., & Kosanovich, M. (2008). *Effective instruction for adolescent struggling*

- readers: *A practice brief*. Portsmouth, NH: RMC Research, Center on Instruction.
- Brown, A. L., & Day, J. D. (1983). Macrorules for summarizing texts: The development of expertise. *Journal of Verbal Learning and Verbal Behavior*, 22(1), 1–14.
- Calhoun, M. B., Scarborough, H. S., & Miller, B. (2013). Interventions for struggling adolescent and adult readers: Instructional, learner, and situational differences. *Reading and Writing*, 26, 489–494.
- Chamberlain, A., Daniels, C. N., Madden, N., & Slavin, R. (2007). A randomized evaluation of the Success for All middle school reading program. *Middle Grades Research Journal*, 2(1), 1–21.
- Christle, C. A., Jolivet, K., & Nelson, C. M. (2007). School characteristics related to high school dropout rates. *Remedial and Special Education*, 28(6), 325–339.
- Compton, D. L., Miller, A. C., Elleman, A. M., & Steacy, L. M. (2014). Have we forsaken reading theory in the name of “quick fix” interventions for children with reading disability? *Scientific Studies of Reading*, 18(1), 55–73.
- Cordero-Ponce, W. L. (2000). Summarization instruction: Effects on foreign language comprehension and summarization of expository texts. *Literacy Research and Instruction*, 39(4), 329–350.
- Coyne, M. D., Kame'enui, E. J., Simmons, D. C., & Harn, B. A. (2004). Beginning reading intervention as inoculation or insulin: First-grade reading performance of strong responders to kindergarten intervention. *Journal of Learning Disabilities*, 37(2), 90–104.
- Dynarski, M., Clarke, L., Cobb, B., Finn, J., Rumberger, R., & Smink, J. (2008). *Dropout prevention: A practice guide* (Report No. 2008-4025). Washington, DC: National Center for Education Evaluation and Regional Assistance.
- Fall, A. M., & Roberts, G. (2012). High school dropouts: Interactions between social context, self-perceptions, school engagement, and student dropout. *Journal of Adolescence*, 35, 787–798. doi:10.1016/j.adolescence.2011.11.004
- Fisher, D., & Frey, N. (2014). Close reading as an intervention for struggling middle school readers. *Journal of Adolescent and Adult Literacy*, 57(5), 367–376.
- Foorman, B. R., Francis, D. J., Winikates, D., Mehta, P., Schatschneider, C., & Fletcher, J. M. (1997). Early interventions for children with reading disabilities. *Scientific Studies of Reading*, 1, 255–276.
- Glennie, E., Bonneau, K., Vandellen, M., & Dodge, K. A. (2012). Addition by subtraction: The relation between dropout rates and school-level academic achievement. *Teachers College Record*, 114(8), 1–26.
- Goldschmidt, P., & Wang, J. (1999). When can schools affect dropout behavior? A longitudinal multilevel analysis. *American Educational Research Journal*, 36, 715–738.
- Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77, 81–112.
- Hernandez, D. J. (2012). *Double jeopardy: How third grade reading skills and poverty influence high school graduation*. Retrieved from <http://www.aecf.org/KnowledgeCenter/Publications.aspx?pubguid={8E2B6F93-75C6-4AA6-8C6E-CE88945980A9}>
- Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives*, 2, 172–177.
- Horton, S. V., Lovitt, T. C., & Christensen, C. C. (1991). Notetaking from textbooks: Effects of a columnar format on three categories of secondary students. *Exceptionality: A Special Education Journal*, 2, 19–40.
- Kamil, M. L., Borman, G. D., Dole, J., Kral, C. C., Salinger, T., & Torgesen, J. (2008). *Improving adolescent literacy: Effective classroom and intervention practices. A practice guide* (Report No. 2008-4027). Washington, DC: National Center for Education Evaluation and Regional Assistance.
- Klingner, J., Morrison, A., & Eppolito, A. (2011). Metacognition to improve reading comprehension. In R. E. O'Connor & P. F. Vadasy (Eds.), *Handbook of reading interventions* (pp. 220–253). New York, NY: Guilford Press.
- Lang, L., Torgesen, J., Vogel, W., Chanter, C., Lefsky, E., & Petscher, Y. (2009). Exploring the relative effectiveness of reading interventions for high school students. *Journal of Research on Educational Effectiveness*, 2, 149–175.
- Lee, V. E., & Burkam, D. T. (2003). Dropping out of high school: The role of school organization and structure. *American Educational Research Journal*, 40, 353–393.
- Lipsey, M. W., Puzio, K., Yun, C., Hebert, M. A., Steinka-Fry, K., Cole, M. W., . . . Busick, M. D. (2012). *Translating the statistical representation of the effects of education interventions into more readily interpretable forms* (Report No. 2013-3000). Washington, DC: National Center for Special Education Research.

- MacGinitie, W. H., MacGinitie, R. K., Maria, K., Dreyer, L. G., & Hughes, K. E. (2000). *Gates-MacGinitie Reading Tests* (4th ed.). Itasca, IL: Riverside.
- McCrudden, M. T., Magliano, J. P., & Schraw, G. (2010). Exploring how relevance instructions affect personal reading intentions, reading goals and text processing: A mixed methods study. *Contemporary Educational Psychology*, 35, 229–241.
- Miller, B., McCardle, P., & Hernandez, R. (2010). Advances and remaining challenges in adult literacy research. *Journal of Learning Disabilities*, 43, 101–107.
- National Center for Education Statistics. (2011). *The nation's report card: Reading 2011* (Report No. 2012-457). Washington, DC: Institute of Education Sciences.
- National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common Core State Standards for English language arts & literacy in history/social studies, science, and technical subjects*. Washington, DC: Authors.
- Rayner, K., Foorman, B. R., Perfetti, C. A., Pesetsky, D., & Seidenberg, M. S. (2001). How psychological science informs the teaching of reading. *Psychological Science in the Public Interest*, 2(2), 31–74.
- Reschly, A. L. (2010). Reading and school completion: Critical connection and Matthew effects. *Reading & Writing Quarterly*, 26, 67–90.
- Roberts, G., Torgesen, J. K., Boardman, A., & Scammacca, N. (2008). Evidence-based strategies for reading instruction of older students with learning disabilities. *Learning Disabilities Research & Practice*, 23, 63–69.
- Roberts, G., Vaughn, S., Fletcher, J., Stuebing, K., & Barth, A. (2013). Effects of a response-based, tiered framework for intervening with struggling readers in middle school. *Reading Research Quarterly*, 48, 237–254.
- Rumberger, R. W. (1995). Dropping out of middle school: A multilevel analysis of students and schools. *American Educational Research Journal*, 32, 583–625.
- Rumberger, R. W., & Larson, K. A. (1998). Student mobility and the increased risk of high school dropout. *American Journal of Education*, 107, 1–35.
- Rumberger, R. W., & Lim, S. A. (2008). *Why students drop out of school: A review of 25 years of research* (Report No. 15). Santa Barbara: California Dropout Research Project.
- Rumberger, R. W., & Palardy, G. J. (2005). Test scores, dropout rates, and transfer rates as alternative indicators of high school performance. *American Educational Research Journal*, 41, 3–42.
- Scammacca, N. K., Roberts, G., Vaughn, S., & Stuebing, K. K. (2013). A meta-analysis of interventions for struggling readers in grades 4–12: 1980–2011. *Journal of Learning Disabilities*. Advance online publication. doi:10.1177/0022219413504995
- Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harvard Educational Review*, 78(1), 40–59.
- Somers, M. A., Corrin, W., Sepanik, S., Salinger, T., Levin, J., & Zmach, C. (2010). *The Enhanced Reading Opportunities Study final report: The impact of supplemental literacy courses for struggling ninth-grade readers* (Report No. 2010-4021). Retrieved from <http://ies.ed.gov/ncee/pubs/20104021/pdf/20104021.pdf>
- Texas Education Agency. (2004). *Technical digest 2004–2005*. Retrieved from <http://www.tea.state.tx.us/student.assessment/techdigest/yr0405/>
- Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K. K., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities*, 34, 33–58.
- Vaughn Gross Center for Reading and Language Arts at The University of Texas at Austin. (2010). *Vocabulary and oral language development*. Austin, TX: Author.
- Vaughn, S., & Fletcher, J. M. (2012). Response to intervention with secondary school students with reading difficulties. *Journal of Learning Disabilities*, 45, 241–253.
- Vaughn, S., Klingner, J. K., Swanson, E. A., Boardman, A. G., Roberts, G., Mohammed, S. S., & Stillman-Spisak, S. J. (2011). Efficacy of collaborative strategic reading with middle school students. *American Educational Research Journal*, 48, 938–964.
- Vaughn, S., Roberts, G., Wexler, J., Vaughn, M. G., Fall, A. M., & Schnakenberg, J. B. (2014). High school students with reading comprehension difficulties: Results of a randomized control trial of a two-year reading intervention. *Journal of Learning Disabilities*. Advance online publication. doi:10.1177/0022219413515511

- Vaughn, S., Wexler, J., Leroux, A. J., Roberts, G., Denton, C. A., Barth, A. E., & Fletcher, J. M. (2011). Effects of intensive reading intervention for eighth grade students with persistently inadequate response to intervention. *Journal of Learning Disabilities, 45*, 515–525.
- Wanzek, J., & Vaughn, S. (2007). Research-based implications from extensive early reading interventions. *School Psychology Review, 36*, 541–561.
- Wanzek, J., & Vaughn, S. (2008). Response to varying amounts of time in reading intervention for students with low response to intervention. *Journal of Learning Disabilities, 41*, 126–142.
- Wanzek, J., Vaughn, S., Roberts, G., & Fletcher, J. M. (2011). Efficacy of a reading intervention for middle school students with learning disabilities. *Exceptional Children, 78*, 73–87.
- Wanzek, J., Vaughn, S., Scammacca, N. K., Metz, K., Murray, C. S., Roberts, G., & Danielson, L. (2013). Extensive reading interventions for students with reading difficulties after grade 3. *Review of Educational Research, 83*, 163–195.
- Wanzek, J., Wexler, J., Vaughn, S., & Ciullo, S. (2010). Reading interventions for struggling readers in the upper elementary grades: A synthesis of 20 years of research. *Reading and Writing, 23*, 889–912.
- What Works Clearinghouse. (2013). *Procedures and standards handbook* (Version 3.0). Washington, DC: Institute of Education Sciences.

Manuscript received March 2014; accepted July 2014.