

# Reading & Writing Quarterly

## Overcoming Learning Difficulties

ISSN: (Print) (Online) Journal homepage: <https://www.tandfonline.com/loi/urwl20>

# Exploring the English Language Comprehension, Reading Fluency, and Executive Functions of Spanish-English Bilingual Adolescents with Reading Difficulties

Andrew Weaver & Michael J. Kieffer

To cite this article: Andrew Weaver & Michael J. Kieffer (2022) Exploring the English Language Comprehension, Reading Fluency, and Executive Functions of Spanish-English Bilingual Adolescents with Reading Difficulties, *Reading & Writing Quarterly*, 38:3, 233-252, DOI: [10.1080/10573569.2021.1943580](https://doi.org/10.1080/10573569.2021.1943580)

To link to this article: <https://doi.org/10.1080/10573569.2021.1943580>



Published online: 25 Jul 2021.



Submit your article to this journal [↗](#)



Article views: 555



View related articles [↗](#)





View Crossmark data [↗](#)



Citing articles: 3 View citing articles [↗](#)



# Exploring the English Language Comprehension, Reading Fluency, and Executive Functions of Spanish-English Bilingual Adolescents with Reading Difficulties



Andrew Weaver\*  and Michael J. Kieffer 

New York University, New York City, NY, USA

## ABSTRACT

This study examines differences in English language comprehension, reading fluency, and executive functions among Spanish-English bilinguals with reading difficulties. Reading difficulties examined included general reading difficulties, defined by low word reading and reading comprehension, and specific-reading comprehension difficulties, defined by low reading comprehension yet adequate word reading. Participants ( $N = 86$ ) were categorized using multiple measures of reading comprehension and word reading in each of 6th, 7th, and 8th grade. Participants were also categorized based on persistent difficulties (i.e. remaining in the same group across multiple grades). On two measures of language comprehension, readers with either difficulty tended to demonstrate significant weaknesses relative to average readers. On passage reading fluency, readers with specific-reading comprehension difficulties performed worse than average readers but better than readers with general reading difficulties. On executive functions, readers with general reading difficulties demonstrated weaknesses relative to average readers, but there was little evidence that readers with specific-reading comprehension difficulties showed these weaknesses. These findings typically held when looking at readers with persistently defined difficulties. Longitudinal analyses indicated that 47% of students with S-RCD and 56% of students with GRD remained in their group across the three years, consistent with prior research. Findings highlight potential weaknesses in executive functions for children with general reading difficulties that should be considered when designing instruction for these students. These findings also support prior research on the importance of developing English language and reading fluency for Spanish-English bilingual children with reading difficulties.

Spanish-English bilingual students are a large, growing, and historically underserved population in US classrooms (August & Shanahan, 2006; Takanishi & Menestrel, 2017). Stemming at least partly from socioeconomic contextual factors (Kieffer, 2011; Takanishi & Menestrel, 2017), and not because bilingualism itself is a risk factor, evidence suggests that this population may disproportionately demonstrate English reading difficulties in early adolescence (e.g. Lesaux & Kieffer, 2010). To better inform instruction for students with reading difficulties, researchers have typically examined the reading, linguistic, and cognitive skill profiles of affected monolingual students (e.g. Cain & Oakhill, 2006). Following the Simple View of Reading, which defines reading

**CONTACT** Andrew Weaver  [aww304@nyu.edu](mailto:aww304@nyu.edu)  Department of Teaching and Learning, New York University, 239 Greene St, New York City, NY, 10003, USA.

\*Submitting author.

comprehension as the combination of decoding and linguistic comprehension (Gough & Tunmer, 1986), researchers have investigated: (1) cases where difficulties with word reading impede comprehension and create general reading difficulties (GRD; e.g. Cutting et al., 2009), and (2) cases where children with specific-reading comprehension difficulties (S-RCD) struggle with comprehension despite adequate word reading skills (for a review, see Landi & Ryherd, 2017).

Kim's (2017, 2020) more recent Direct and Indirect Effects Model of Reading updates the Simple View to account for additional componential skills that are hierarchically related to reading comprehension. Specifically, this model posits that listening comprehension, oral reading fluency, and word reading contribute directly to reading comprehension while intermediate variables including vocabulary and distal variables including domain-general cognitive skills known as executive functions contribute indirectly to reading comprehension. This model provides a case for studying differences between average readers and readers with either GRD or S-RCD on language comprehension, reading fluency, and executive functions. Preliminary research on the unique profiles of multilingual students with GRD or S-RCD indicates that these students demonstrate difficulties in these proximal and distal skills, but different performance in these domains, which may contribute to their distinct profiles (Geva & Massey-Garrison, 2013; Li & Kirby, 2014; Spencer & Wagner, 2017). Examining how these groups differ in these domains will aid researchers in better understanding these difficulties, and provide teachers seeking to intervene with more comprehensive information about the needs of these students.

However, researchers have rarely examined the reading profiles of bilingual adolescents with S-RCD and GRD in these domains longitudinally. Recent work with Spanish-English bilingual and English monolingual elementary students has found that 41% of students identified with S-RCD in fall of Grades 1–3 will remain with this same profile, or “persist,” across two academic years (Taboada Barber et al., 2020). Prior work has similarly found that 65% of monolingual and bilingual students with S-RCD at Grades 2 and 3 persist in low comprehension at Grade 7 (Etmanskie et al., 2016). This work highlights important issues of S-RCD persistence across the elementary years into early adolescence, and the need for early identification and intervention. Thus, more research is needed on the extent to which both S-RCD and GRD persist (i.e. remain with these same profiles) across early adolescence, and the distinct profiles of those with persistent difficulties by the end of middle school.

In this longitudinal study, we examine how groups of Spanish-English bilingual average readers, readers with S-RCD, and readers with GRD differ on componential skills in grades 6–8. Based on the Simple View (Gough & Tunmer, 1986) we look at students with common profiles of reading difficulties. Following Kim's (2017, 2020) Direct and Indirect Effects Model, we examine aspects of language comprehension, word reading fluency, oral reading fluency, and executive function skills posited to contribute to reading comprehension. Additionally, given past research on the persistence of S-RCD in childhood and to early adolescence for bilingual children (Etmanskie et al., 2016; Taboada Barber et al., 2020), we investigate the extent to which students with GRD and S-RCD persist with the same profile across early adolescence to help identify skill profiles of those students who will need targeted support and intervention by high school.

## Language comprehension

Kim's (2017, 2020) Direct and Indirect Effects Model of Reading identifies language comprehension as a direct contributor to reading comprehension, meaning adolescent readers with either S-RCD or GRD may demonstrate language comprehension difficulties. Given their adequate word reading, readers with S-RCD have been dubbed “hyperlexic” and defined in part by language comprehension difficulties (Catts et al., 2003; Gough & Tunmer, 1986). Readers with GRD are thought to acquire less vocabulary than their peers stemming from early difficulty with decoding and less reading experience (Stanovich, 1986), indicating language comprehension difficulties may

emerge and worsen over time for this group. Furthermore, a substantial body of research demonstrates the general importance of oral language development for early literacy skills and reading comprehension in Spanish-English bilingual children (August & Shanahan, 2006; Edyburn et al., 2017; Gonzalez et al., 2016; Hammer et al., 2014; Proctor et al., 2005). A recent meta-analysis of 16 studies on reading difficulties in second-language learners found large and significant differences in oral language performance between second-language learner average readers and children with S-RCD (Spencer & Wagner, 2017). However, this meta-analysis also recognized that oral language difficulties could not fully explain the comprehension difficulties of children with S-RCD. Recent longitudinal work on Spanish-English bilingual children similarly finds language comprehension difficulties for children with S-RCD that do not fully explain their comprehension difficulties (Taboada Barber et al., 2020). Thus, a wealth of research supports the importance of oral language development with bilingual children and monolingual children with S-RCD, but more research is necessary to understand the specific oral language instructional needs of those Spanish-English bilingual adolescents with different reading difficulties. Additionally, research on other direct and indirect contributors to reading comprehension is needed to understand other sources of difficulties.

### Reading fluency

Oral reading fluency describes the ability to quickly reproduce text into speech and requires the coordination of componential skills to efficiently process text (Fuchs et al., 2001). Whereas word reading fluency indicates the level of automaticity in bottom-up decoding processes (LaBerge & Samuels, 1974), contextual oral reading fluency may further indicate the ability to utilize text and sentence structure information to process meaningful connections and thus require top-down text meaning processes (Kuhn & Stahl, 2003; Samuels, 2006). In Kim's model (2017, 2020), reading fluency directly contributes to reading comprehension, indicating this may be a source of difficulty for students with S-RCD beyond language comprehension. One study with a monolingual sample reported that average readers performed significantly better on a measure of passage reading fluency than readers with S-RCD, who in turn scored significantly higher than readers with GRD (Cutting et al., 2009). These authors argued that students with S-RCD may struggle with the additional coordination and language-based skills beyond word recognition necessary for passage reading fluency but perform better than children with GRD due to their successful decoding. Further research has identified a prevalent "slow word caller" profile of low-average word and passage fluency demonstrated in concert with above-average non-word reading accuracy and low vocabulary in a sample of struggling readers including bilingual students (Lesaux & Kieffer, 2010). Given the widespread and recommended use of fluency measures to identify students in need of additional instructional support (Fuchs et al., 2001), identifying distinct fluency profiles of bilingual students with reading difficulties will help teachers detect these difficulties.

### Executive functions

Executive functions describe a set of higher-order cognitive processes that facilitate planning, problem solving, and initiation and maintenance of goal-directed behavior (Pennington & Ozonoff, 1996). Conceptions of executive functions stress the unity of the system, but also the diversity of three componential skills (Miyake et al., 2000): (1) attention shifting (or cognitive flexibility or set shifting) describes the capacity to shift between tasks or rules; (2) working memory is the capacity to hold and manipulate pieces of information in the mind (Baddeley & Hitch, 1974); and (3) inhibitory control describes the capacity to suppress a dominant response (Miyake et al., 2000). Theories of reading argue that attention shifting and working memory act as limiting constraints for reading while inhibitory control facilitates reading by allowing for suppression of

irrelevant stimuli, like extraneous noise in a busy classroom (Duke & Cartwright 2019; LaBerge & Samuels, 1974; Kintsch, 1998). While substantial empirical research has linked working memory to components of reading comprehension (Swanson & Siegel, 2001), recent research finds executive functions make direct contributions to reading comprehension and indirect contributions via both language comprehension and word reading (Arrington et al., 2014; Kieffer et al., 2013; Locascio et al., 2010; Sesma et al., 2009). Based on Kim's model (2017, 2020), these indirect contributions via word reading and language comprehension indicate that executive function difficulties may further characterize either GRD or S-RCD. If executive function difficulties do coincide with either GRD or S-RCD, teachers should consider these individual differences when designing classroom structures for these students, as recent work finds that executive functions relate to classroom behavior (Johnson et al., 2020).

Research on monolingual students with GRD and S-RCD has found varying evidence that these students struggle with executive functions relative to average readers (Cartwright et al., 2017; Cutting et al., 2009; Geva & Massey-Garrison, 2013; Locascio et al., 2010; Sesma et al., 2009). Thus, research on bilingual students with GRD and S-RCD is needed to determine whether executive function difficulties may exist for these students to inform instructional supports and classroom environments created by teachers. One recent longitudinal study found no evidence of differences between elementary-aged bilingual average readers and children with S-RCD on measures of executive functions (Taboada Barber et al., 2020), but more research is needed. Although a body of research has explored how executive functions may develop differently for bilinguals compared to monolinguals (Adesope et al., 2010; Bialystok, 2005; Carlson & Meltzoff, 2008), with some evidence doubtful of group differences (de Bruin et al., 2015; Dick et al., 2019; Paap et al., 2015), we focus instead on the executive function profiles among only Spanish-English bilingual adolescents with different reading difficulties.

### **Current study**

The purpose of this longitudinal study is to extend findings on the role of language comprehension, reading fluency, and executive functions in monolingual and bilingual children with S-RCD and GRD to a bilingual population in early adolescence (Grades 6 to 8). Following Kim's (2017; 2020) Direct and Indirect Effects of Reading model, we examine key contributors to reading comprehension expected to differ among readers with difficulties. Furthermore, this study also examines the extent to which the reading difficulties of bilingual adolescents persist (i.e. the extent to which students remain with these profiles) across Grades 6 to 8, and profiles of students with persistent difficulties. This project is part of a larger longitudinal study (Kieffer et al., 2021) on bilingual students' reading, language, and cognitive development; the unique contribution of this study comes from its focus on skill profiles of students with reading difficulties. Students were recruited in Grade 6 and completed a battery of linguistic and reading measures through Grade 8. We created groups using measures of reading comprehension and word reading in each of Grade 6, 7, and 8. We also examined the extent to which students persist with their profile at Grades 7 and 8, and skill differences between the groups when persistently defined. Creating groups based on persistence allows for the identification of students with continued reading difficulties throughout middle school, rather than including students who may be struggling in one particular grade or are falsely identified in a single year due to measurement error. The middle school years represent a period of immense developmental shifts, where the demands for readers change as texts become more disciplinary and complex (Shanahan & Shanahan, 2008). By identifying the measures of concern for persistently grouped students during middle school, teachers and stakeholders may be able to target students for high school intervention. Thus, we examine performance of students with reading difficulties to identify potential sources of difficulties, as

well as areas that may need consideration in adolescent intervention design. We investigated the following questions:

1. Among Spanish-English bilinguals, how do language comprehension, reading fluency, and executive functions differ for average readers compared to readers with S-RCD and GRD in each of Grade 6, 7, and 8?
2. Among Spanish-English bilinguals, to what extent do reading profiles (average readers, S-RCD, and GRD) persist from Grades 6 to 7 and across Grades 6 to 8?
3. Among Spanish-English bilinguals, how do language comprehension, reading fluency, and executive functions differ for persistently defined average readers compared to readers with persistent S-RCD and GRD across Grades 6–8?

## Method

### Participants

Participants were drawn from a larger longitudinal project in which 117 Spanish-English bilingual students (68 females) were recruited in Grade 6 from three New York City schools and followed for three years. Participants were on average 11.6 years old in Grade 6, 12.6 in Grade 7, and 13.6 in Grade 8. This project was approved by the Institutional Review Board at New York University and was conducted in accordance with APA guidelines for human subjects research. Students were considered for participation if their parents reported speaking Spanish to some extent at home, and no students were excluded based on proficiency levels in either language consistent with an inclusive notion of “bilingual” reflective of the linguistic diversity of American schools (Takanishi & Menestrel, 2017). Parents reported their home language use on a researcher-designed survey (Lesaux et al., 2010) that was sent home.

Home language use varied, with 20% reporting speaking mostly English, 61% reporting speaking English and Spanish equally, 10% reporting speaking mostly Spanish, and 9% reporting speaking only Spanish. The sample also demonstrated wide variation in Spanish and English proficiency. Although not considered in present analyses, students were assessed for descriptive purposes on Spanish receptive vocabulary on the Test de Vocabulario en Imagenes Peabody (Dunn et al., 1986) and Spanish letter-word identification on the Woodcock-Muñoz Language Survey-Revised (Woodcock et al., 2005) in Grade 6. Students demonstrated low Spanish vocabulary standard scores on average relative to monolingual Spanish norms, but wide variation ( $M=77.42$ ,  $SD=19.86$ ). Students demonstrated average Spanish letter-word identification, but again with wide variation ( $M=98.41$ ,  $SD=25.90$ ). A minority of the sample (25% in Grade 6; 14% in Grade 7; 11% in Grade 8) were classified as English Learners. Among those classified as English learners in Grade 6, most (83%) scored at the “Advanced” English proficiency level on the New York State English-as-a-Second-Language Achievement Test, while the remaining minority (17%) scored at the “Intermediate” level. In Grade 6, a minority of the sample received transitional bilingual education (5%), dual language education (14%), and English as a second language instruction (15%), while the remainder (65%) received no special language services. The majority of the students (92%) received free or reduced lunch. Attrition was low, with 106 of the 117 recruited students participating again in Grade 7 and 102 participating in Grade 8, while three students were excluded for missing data on individual measures. Of the 99 students who completed all measures in each grade, 86 were classified in a reading group in at least one grade and thus constituted the analytic sample (see below). *T*-test and chi-squared test results revealed no significant differences in gender, ethnicity, Grade 6 free and reduced lunch status, or Grade 6 English reading and language measures between attrited students and included participants.

## **Measures**

Participants were tested in each of Grade 6, 7, and 8 on the same battery of English reading, language, and cognitive measures.

### **Reading comprehension**

We created reading comprehension composites using the Gates-MacGinitie Reading Comprehension Test, 4th edition and the multiple-choice reading section of the Grades 6–8 Common Core English Language Arts New York State Testing Program. The 35 min Gates-MacGinitie consists of literal and inferential multiple-choice questions based on short, grade-level passages culled from narrative and informational texts (MacGinitie et al., 2002). The publisher reports reliability coefficients of .91–.92. The Grades 6–8 Common Core English Language Arts New York State Testing Program consists of multiple-choice and writing questions based on medium-length grade-level passages requiring analysis of different text aspects, including main idea, style elements, character and plot development, and vocabulary (New York State Education Department, 2015). Students have a total of 180 min over two days to complete the full assessment. For the purposes of the present study, we utilized the multiple-choice reading subscore data from the 2014 Grade 6 form (reliability = .88), the 2015 Grade 7 form (reliability = .81), and the 2016 Grade 8 form (reliability = .87). Given evidence on the variability in reading comprehension measures and the component skills they draw on (e.g. Cutting & Scarborough, 2006; Keenan et al., 2008), we determined that a composite would minimize the influence of idiosyncrasies in each measure and more fully capture reading comprehension. Correlations between the two tests were strong ( $r = .62-.78$  across the grades), indicating that a composite was appropriate.

### **Word reading accuracy**

We created an English word reading composite using the Woodcock-Johnson III (Woodcock et al., 2001) Word Attack subtest (reliability = .87) and the WJ-III Letter-word Identification subtest (reliability = .94). The Word Attack subtest requires participants to accurately decode non-words, and the Letter-word Identification subtest requires accurate reading of single letters and words. Correlations between the two tests were strong ( $r = .72-.80$  across the grades), indicating that a composite would be appropriate.

### **Language comprehension**

We used measures of receptive vocabulary and listening comprehension to measure language comprehension. We assessed English receptive vocabulary using the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 1997; internal consistency reliability is .92–.98). For this assessment students hear a word read aloud by a test administrator and select one of four pictures that best matches the word's meaning. For analyses we used the Growth Scale Value score, which yields an equal-interval scale score making comparisons across grades possible. We assessed participants' English listening comprehension with the listening comprehension subtest of the Group-administered Reading Assessment and Diagnostic Evaluation (GRADE; Williams, 2002; internal consistency reliability is .68). For this assessment students hear a sentence or pair of sentences read aloud by a test administrator and choose one of four pictures to best represent what they heard. The GRADE Grade 6 form was used for all three years because a vertically equated form with appropriate developmental scores is not available; the manual suggests that the test is appropriate for up to two grades above the Grade 6 form (Williams, 2002).

### **Reading fluency**

We assessed oral reading fluency using the Oral Reading Fluency (ORF) subtest of the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Good & Kaminski, 2002; reliability is .93–.98 across the grades). For this assessment children read four passages for one minute each. Test administrators record words omitted, substitutions, and hesitations lasting longer than three seconds as errors, while hesitations followed by self-correction in less than three seconds count as correct. An average of words read correctly across the four passages was used. Since the DIBELS ORF only has forms through Grade 6, the Grade 6 version was administered in all three years. We also assessed word reading fluency using the Test of Word Reading Efficiency-2 Sight Word Efficiency subtest (TOWRE-2; Torgesen et al., 2012; reliability = .90–.91). For this assessment children must accurately read aloud as many words as possible from a vertical list of real words in 45 seconds.

### **Executive functions**

We assessed executive functions with measures capturing the three skills of attention shifting, inhibitory control, and working memory. To measure attention shifting, we used a computerized version of the Wisconsin Card Sorting Test (WCST), 64-card version (Kongs et al., 2000). For the WCST, children sort cards of various shapes, numbers, and colors along an unspecified dimension (e.g. shape) and must determine the sorting rule from feedback. After ten correct sorting moves, the sorting rule changes to a new dimension (e.g. color) and children must use feedback to determine the new rule. We used the number of perseverative errors (i.e. errors made using a previous rule after receiving feedback that it is no longer active) to determine difficulty with attention shifting. Reliability across the grades was adequate (Cronbach's alpha = .89 in Grade 6, .71 in Grade 7, .70 in Grade 8). To measure a combination of attention shifting and inhibitory control, we used a flanker task with reverse flanker and mixed trials based on prior research (e.g. Blair & Raver, 2014; Diamond et al., 2007). For this task, participants complete 20 randomized trials consisting of five fish, with the middle fish either facing the same direction (congruent) or a different direction (incongruent) than the surrounding four fish. Participants must select the direction of the middle fish for trials where the fish are blue (flanker items), and select the direction of the outside fish for trials where the fish are pink (reverse flanker items). These flanker and reverse-flanker items are mixed at random, requiring participants to flexibly shift attention between rules while inhibiting distracting stimuli. Children completed practice trial blocks with both congruent and incongruent trials, which repeat if they do not achieve 75% correct. Task performance was scored using a method adapted from the scoring guide for the NIH Toolbox flanker task (Slotkin et al., 2012) that combines percent accuracy across congruent and incongruent trials with response time for correctly completed incongruent trials. The resulting scaled score ranged from 0 to 10; scores for students with accuracy below 80% represented their accuracy alone, while scores for students with accuracy above 80% (i.e. those with sufficient scores for reliably measuring response time) represented an equally weighted combination of accuracy and response time. In the latter case, the response time component was based on a student's median response time (after excluding response times that were no more than 3 SDs away from the student's mean) that was rescaled using log values of the median response time relative to the minimum and maximum possible response times, such that higher scores represented faster performance (Slotkin et al., 2012). Reliability across the grades was adequate for accuracy (Cronbach's alpha = .75–.80) and for response time (for the subset of students with accuracy above 80%; Cronbach's alpha = .76–.84).

In addition to the Fish Flanker task, we measured inhibitory control using a visual Simon task based on a version from Bialystok et al. (2004). For this computerized task, children press the left shift key when they see a blue square and the right shift key when they see a red square, regardless of the square's position onscreen. Children complete 28 trials, of which half are congruent



with the square's position on the same side as the correct shift key, while half are incongruent and require the children to ignore the conflicting position of the square on the screen. The task is scored to combine accuracy and response time using the same method from Slotkin et al. (2012) described above. Reliability across the grades was adequate for accuracy (Cronbach's alpha = .79–.82) and for response time (for the subset of students with accuracy above 80%; Cronbach's alpha = .74–.81).

We assessed working memory using a computerized, backward digit span task developed by Woods et al. (2011) based on Wechsler's (1939) paradigm. For this individually adaptive task, the number of digits on each item is determined by their prior performance. The task continues for 14 items, giving children a chance to complete several items at or near their true maximum digit span. All participants must complete a practice trial with two digits correctly before proceeding to the test trials. We used the mean span score for analyses, which is an estimate of the digit span at which students are predicted to complete the task with 50% accuracy, a score found to be the most reliable (test-retest reliability = .84; Woods et al., 2011).

### **Creation of composites**

To create composites for reading comprehension and word reading, we first estimated z-scores by subtracting the mean of the norming sample from the participants' scores and then dividing by the standard deviation of the norming sample. Next, we averaged performance across the two scores, in part to ensure that students with discrepant performance would not be misidentified. Finally, we converted composite scores to percentile ranks. This process thus accounts for different scales while retaining the information about the students' performances relative to the norming sample.

### **Creation of groups**

Children who did not meet the cut score criteria for any group were excluded from analyses, allowing for the evaluation of distinctly classified reading groups. Cut scores were based on prior research (Cutting et al., 2009; Taboada Barber et al., 2020), but with the use of composites to minimize misclassification due to measurement error (Locascio et al., 2010; Potocki et al., 2017). Children were identified as average readers if they were at or above the 40th percentile on both the word reading composite and the reading comprehension composite. Children with specific-reading comprehension difficulties (S-RCD) were identified if they were at or below the 25th percentile on the reading comprehension composite and at or above the 40th percentile on the word reading composite. Children with general reading difficulties (GRD) were identified by a score at or below the 25th percentile on both the word reading and reading comprehension composites.

We created groups for each of Grades 6, 7, and 8, as well as those persistently defined across Grades 6–8. The Grade 6 groups included 28 average readers, 16 with GRD, 15 with S-RCD, and 40 students not classified. The Grade 7 groups included 29 average readers, 21 with GRD, 16 with S-RCD, and 33 students not classified. The Grade 8 groups included 38 average readers, 13 with GRD, 16 with S-RCD, and 32 students not classified. Across the three grades examined, 13 students were never classified in a group, resulting in a total sample of 86 students.

## **Results**

We used dummy variable regression analyses with group specified by a set of two dummy variables to understand differences on measures of language comprehension, reading fluency, and executive function between groups for cross-section and longitudinal analyses. Average readers were the reference category when comparing differences between average readers and both the

specific-reading comprehension (S-RCD) and general reading difficulties (GRD) groups. S-RCD was the reference category when comparing differences between the S-RCD and GRD groups.

### **Cross-Sectional differences for bilingual students with S-RCD and GRD**

Table 1 contains means, significant pairwise comparisons, and effect sizes using Hedges's  $g$  for cross-sectional groups. We estimated both Cohen's  $d$  and Hedges's  $g$  effect size metrics; the resulting estimates differed by no more than 0.05. We present Hedges's  $g$  as the primary effect size to correct for potential small sample bias.

#### **Language comprehension**

Regression analyses revealed group differences on measures of language comprehension in each grade (Table 1). Readers with GRD performed significantly worse than average readers on the PPVT-4 and GRADE listening comprehension in all grades (PPVT-4:  $g = -1.77$  to  $-1.04$ , all  $ps < .005$ ; GRADE:  $g = -1.12$  to  $-0.82$ , all  $ps < .05$ ). Readers with GRD performed significantly worse than readers with S-RCD on the PPVT-4 in Grade 8 ( $g = -0.95$ ;  $p = .007$ ), but not in any other grade or on the GRADE listening comprehension (all  $ps > .05$ ). Readers with S-RCD also performed significantly worse than average readers on the PPVT-4 in Grade 6 and Grade 8 ( $g = -1.14$  to  $-0.69$ , all  $ps < .05$ ), but not in Grade 7 ( $p > .05$ ). Readers with S-RCD performed significantly worse than average readers on the GRADE listening comprehension in all grades ( $g = -1.19$  to  $-0.72$ , all  $ps < .05$ ).

#### **Reading fluency**

Dummy variable regression analyses revealed group differences on measures of word and passage fluency in each grade (Table 1). Readers with GRD performed significantly worse than average readers on the TOWRE-2 sight word efficiency and DIBELS-ORF in all three grades (TOWRE-2:  $g = -1.82$  to  $-1.30$ , all  $ps < .001$ ; DIBELS-ORF:  $g = -2.26$  to  $-1.83$ , all  $ps < .001$ ). Additionally, readers with GRD performed significantly worse than readers with S-RCD on the TOWRE-2 and DIBELS-ORF in all three grades (TOWRE-2:  $g = -1.83$  to  $-1.20$ , all  $ps < .005$ ; DIBELS-ORF:  $g = -1.45$  to  $-0.95$ , all  $ps < .005$ ).

Readers with S-RCD were not significantly different from average readers on the TOWRE-2 in any grade (all  $ps > .05$ ). However, readers with S-RCD did perform significantly worse than average readers on the DIBELS-ORF task in all three grades ( $g = -1.17$  to  $-0.83$ , all  $ps < .05$ ).

#### **Executive functions**

Regression analyses with group specified by a set of two dummy variables revealed group differences on measures of executive functions in each grade (Table 1). Children with GRD demonstrated significant difficulties in executive functions relative to average readers across all tasks. Readers with GRD performed significantly worse (i.e. made more perseverative errors) than average readers on the WCST in Grade 6 and Grade 8 ( $g = 0.72$  to  $0.90$ , all  $ps < .05$ ), but not in Grade 7 ( $g = 0.13$ ;  $p = .652$ ). (For the WCST, a higher score indicates more perseverative errors and thus, worse performance.) Additionally, readers with GRD performed significantly worse than readers with S-RCD on the WCST in Grade 6 and Grade 8 ( $g = 0.69$  to  $0.74$ ; all  $ps < .05$ ), but not in Grade 7 ( $g = 0.36$ ;  $p = .255$ ). Readers with GRD also performed significantly worse than average readers on the Fish Flanker task in every grade ( $g = -1.03$  to  $-0.71$ , all  $ps < .05$ ). However, readers with GRD were not significantly different from readers with S-RCD on the Fish Flanker in any grade (all  $ps > .05$ ). On the Simon task, readers with GRD performed significantly worse than average readers in every grade ( $g = -0.85$  to  $-0.72$ , all  $ps < .05$ ). Additionally,

Table 1. Means, standard deviations, significant differences, and effect sizes for cross-sectional groups.

Measure	Grade	Average reader		GRD		S-RCD		Group comparisons (Hedge's <i>g</i> )		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	GRD vs. Average	S-RCD vs. Average	GRD vs. S-RCD
PPVT-4 – Receptive Vocabulary	Grade 6	182.61	11.12	165.19	19.02	169.40	11.70	-1.18***	-1.14**	-0.26
	Grade 7	188.55	10.68	171.57	21.45	180.00	9.70	-1.04**	-0.81	-0.47
	Grade 8	193.08	9.94	175.00	10.46	185.81	11.50	-1.77***	-0.69*	-0.95**
GRADE – Listening Comprehension	Grade 6	13.71	1.74	11.69	2.41	12.07	1.58	-0.99**	-0.96**	-0.18
	Grade 7	14.93	1.46	12.86	2.24	12.48	2.85	-1.12***	-1.19**	0.16
	Grade 8	14.84	2.06	13.23	1.54	13.31	2.21	-0.82*	-0.72*	-0.04
TOWRE-2 – Sight Word Efficiency	Grade 6	75.29	10.84	54.75	12.42	73.20	5.81	-1.76***	-0.22	-1.83***
	Grade 7	79.07	11.91	63.29	11.92	75.44	6.29	-1.30***	-0.35	-1.20**
	Grade 8	85.37	9.31	67.85	9.90	81.06	8.11	-1.82***	-0.47	-1.44***
DIBELS – Oral Reading Fluency	Grade 6	133.75	28.25	71.34	26.86	109.05	23.47	-2.21***	-0.91**	-1.45***
	Grade 7	150.68	22.83	98.32	34.36	129.53	28.48	-1.83***	-0.83*	-0.95**
	Grade 8	165.65	29.01	96.12	34.04	133.72	21.00	-2.26***	-1.17***	-1.34**
WCST – Attention Shifting	Grade 6	13.50	5.41	19.00	6.90	14.60	5.45	0.90**	0.20	0.69*
	Grade 7	14.14	6.02	14.95	6.66	12.56	6.17	0.13	-0.25	0.36
	Grade 8	12.00	4.64	16.00	7.58	11.50	4.21	0.72*	-0.11	0.74*
FF – Attention Shifting/ Inhibitory Control	Grade 6	5.25	1.45	4.23	1.34	4.43	1.38	-0.71*	-0.56	-0.14
	Grade 7	5.87	1.32	4.27	1.79	4.92	1.31	-1.03***	-0.71*	-0.40
	Grade 8	6.99	1.94	5.31	2.05	5.80	2.34	-0.84*	-0.57	-0.21
Simon - Inhibitory Control	Grade 6	6.02	1.47	4.88	1.69	5.63	1.19	-0.72*	-0.28	-0.50
	Grade 7	6.63	0.97	5.58	1.72	5.72	1.46	-0.77**	-0.77*	-0.08
	Grade 8	6.72	1.29	5.37	2.18	6.71	0.62	-0.85**	-0.01	-0.86*
BDS – Working Memory	Grade 6	4.28	0.74	3.35	0.61	4.28	0.71	-1.31***	-0.01	-1.36**
	Grade 7	4.44	0.86	3.61	0.67	4.41	0.74	-1.04***	-0.04	-1.11**
	Grade 8	4.83	0.86	3.55	0.61	4.63	0.59	-1.56***	-0.26	-1.75***

\**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

readers with GRD performed significantly worse than readers with S-RCD on the Simon task in Grade 8 ( $g = -0.86$ ;  $p < .001$ ), but not in Grade 6 or Grade 7 (all  $ps > .05$ ). Readers with GRD performed significantly worse than average readers on the Backwards Digit Span task in every grade ( $g = -1.56$  to  $-1.04$ , all  $ps < .001$ ). Readers with GRD also performed significantly worse than readers with S-RCD on the Backwards Digit Span task in every grade ( $g = -1.75$  to  $-1.11$ , all  $ps < .01$ ).

Readers with S-RCD only demonstrated significant weakness relative to average readers on the Fish Flanker task ( $g = -0.71$ ;  $p = .044$ ) and Simon task ( $g = -0.77$ ;  $p = .036$ ) in Grade 7 but were otherwise not significantly different from average readers in any executive functions task at any grade level (all  $ps > .05$ ).

### **Longitudinal persistence of SRCD and GRD**

To address the second research question on the longitudinal persistence of reading difficulties in adolescence, we examined the changes in group classification at each of Grades 7 and 8. Students who did not move into another group demonstrated word reading or reading comprehension composite scores that did not meet the threshold for any group classification.

#### **Grade 6 to Grade 7**

We first examined the extent to which students remained in their same reading group from Grade 6 to Grade 7. Table 2 shows these results, with original Grade 6 groups in the rows and Grade 7 groups on the left-hand columns. Students on the diagonal of the Grade 7 columns remained in their same group from Grade 6 to Grade 7 or remained marginal. Results indicated that 42 of the 59 students (71%) from the Grade 6 analytic sample remained in their same group in Grade 7. Across these two grades 5 of the 59 students (8%) changed groups, and 12 of the 59 moved into marginal groups (20%). For the GRD group, 13 of the 16 (81%) students remained in this group in Grade 7, while the remainder were not classified. For students with S-RCD, 9 of the 15 (60%) remained in this group in Grade 7, while 2 (13%) moved to the GRD group and 1 (7%) to the average readers group. In the average readers group, 20 out of 28 (71%) remained average readers in Grade 7, while 1 (4%) moved to the GRD group, and 1 (4%) to the S-RCD group.

#### **Grade 6 through Grade 8**

We also examined the extent to which students remained in their same reading group across Grade 6, 7, and 8. Table 3 shows these results, with Grade 8 columns on the right-hand side. Note that movement here represents movement from Grade 7 persistent groups (i.e. students in the same group in Grade 6 and 7) to Grade 8 groups rather than movement between cross-sectional groups. Results indicated that 36 of the 59 students (61%) from the Grade 6 analytic sample remained in their same group through Grade 8. Across the three years, 6 of the 59 students (10%) changed groups, and 17 of the 59 (29%) moved into marginal groups. For the GRD group, 9 of the 16 (56%) students remained in this group across the three years. For the S-RCD group, 7 of the 15 (47%) students remained in this group across the three years, while 1 (7%) student

**Table 2.** Movement of reader among groups from Grades 6 to 8, with persistence in **Bold** for Grade 7 and Grade 8.

Original Grade 6 Group	Grade 7				Grade 8			
	S-RCD	GRD	Average Readers	Marginal	S-RCD	GRD	Average Readers	Marginal
S-RCD ( $n = 15$ )	<b>9</b>	2	1	3	<b>7</b>	–	1	1
GRD ( $n = 16$ )	0	<b>13</b>	–	3	–	<b>9</b>	–	4
Average Readers ( $n = 28$ )	1	1	<b>20</b>	6	–	–	<b>20</b>	–
Marginal ( $n = 40$ )	6	5	8	21	2	1	5	13

moved from S-RCD to average reader between Grade 7 and Grade 8. For average readers, 20 of the 28 (71%) remained in this group from Grade 6 to Grade 8, with all movement happening from Grade 6 to Grade 7 as noted above.

### **Differences among persistent groups**

We next examined the group differences between students who remained in the same group across the three years on measures of language comprehension, reading fluency, and executive functions. Table 3 contains means, significant pairwise comparisons, and effect sizes using Hedges's  $g$  for persistently defined groups. Results were largely similar to the cross-sectional results, but we note differences from those analyses. In Grade 6, readers with persistent GRD demonstrated additional significant difficulties relative readers with persistent SRCD on the Simon inhibitory control task ( $g = -1.51, p = .006$ ). Additionally, readers with persistent GRD were no longer significantly different from readers with persistent SRCD on the Backwards Digit Span working memory task ( $p = .14$ ).

In Grade 7 readers with S-RCD demonstrated additional significant difficulties relative to average readers on the PPVT-4 receptive vocabulary measure ( $g = -1.29, p = .007$ ) and on the TOWRE-2 sight word efficiency subtest ( $g = -0.90, p = .048$ ). Additionally, readers with S-RCD were no longer different from average readers on the Fish Flanker attention shifting/inhibitory control task when groups were persistently defined ( $p = .08$ ). Readers with GRD demonstrated additional difficulties relative to readers with S-RCD on the PPVT-4 ( $g = -0.89; p = .044$ ) and the WCST attention shifting measure ( $g = 1.16, p = .02$ ).

For Grade 8, results were largely similar to cross-sectional results, except that students with persistent GRD were no longer different from students with S-RCD on the PPVT-4 ( $p = .098$ )

## **Discussion**

Our study examined differences between Spanish-English bilingual adolescents with either specific-reading comprehension difficulties (S-RCD) or general reading difficulties (GRD) on measures of oral language, word and passage reading fluency, and executive functions, as these skills are posited by theory to be direct and indirect contributors to reading comprehension, and likely sources of their difficulties (Kim, 2017, 2020). Our results indicate that students with S-RCD or GRD demonstrate significant weaknesses on measures of English language comprehension and passage fluency relative to average readers. For passage fluency, we additionally found readers with S-RCD significantly outperform readers with GRD. For measures of executive functions, readers with GRD demonstrated pronounced difficulties relative to average readers in all skills as well as difficulties in working memory relative to readers with S-RCD. Contrary to some prior research with monolinguals (e.g. Cutting et al., 2009), but consistent with recent research on Spanish-English bilingual students (Taboada Barber et al., 2020), there was little evidence of executive function difficulties for students with S-RCD. The differences we did observe were associated with consistently large effect sizes according to Cohen's (1992) benchmarks in addition to being statistically significant.

We also examined the longitudinal persistence of reading difficulties during early adolescence. We found that GRD was slightly more stable than S-RCD, with 56% of students initially classified with GRD remaining in this group by Grade 8, compared to 47% for students with S-RCD. Average readers were the most stable group, with 70% of students remaining in this group across the three years. Furthermore, the differences between groups generally held when looking at differences among persistently defined groups that utilized longitudinal information from repeated, multiple measures of reading comprehension and word reading across Grades 6–8. This process allowed us to define GRD and S-RCD more reliably than previous research and identify areas in

**Table 3.** Means, standard deviations, significant differences, and effect sizes for persistent groups.

Measure	Grade	Average reader		GRD		S-RCD		Group Comparisons (Hedge's <i>g</i> )		
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	GRD vs. Average	S-RCD vs. Average	GRD vs. S-RCD
PPVT-4 – Receptive Vocabulary	Grade 6	183.90	11.48	163.89	9.88	167.57	12.31	-1.76***	-1.35**	-0.32
	Grade 7	191.75	9.59	167.22	12.30	178.43	11.28	-2.28***	-1.29**	-0.89*
	Grade 8	197.75	9.72	174.00	10.72	182.86	11.51	-2.30***	-1.42**	-0.76
GRADE – Listening Comprehension	Grade 6	14.05	1.73	11.56	2.65	11.86	1.35	-1.18**	-1.29*	-0.13
	Grade 7	15.35	1.46	12.56	2.19	13.00	2.00	-1.59***	-1.42**	-0.20
	Grade 8	15.45	1.57	12.78	1.48	13.86	1.07	-1.68***	-1.05*	-0.77
TOWRE-2 – Sight Word Efficiency	Grade 6	78.30	6.28	50.33	13.95	74.71	6.73	-2.94***	-0.54	-2.02***
	Grade 7	81.10	11.91	57.44	11.74	71.29	3.99	-1.94***	-0.90*	-1.41*
	Grade 8	87.45	11.68	65.11	8.94	79.29	7.34	-1.99***	-0.73	-1.62*
DIBELS – Oral Reading Fluency	Grade 6	144.39	22.57	62.06	23.52	112.04	14.78	-3.50***	-1.50**	-2.33***
	Grade 7	158.00	20.74	74.28	26.91	114.29	13.25	-3.58***	-2.21***	-1.71**
	Grade 8	180.31	25.92	89.50	26.93	132.50	17.05	-3.37***	-1.92***	-1.75**
WCST – Attention Shifting	Grade 6	13.95	6.28	22.33	5.96	13.29	5.94	1.32**	-0.10	1.44*
	Grade 7	13.00	5.50	17.11	6.29	10.29	4.46	0.70	-0.50	1.16*
	Grade 8	11.65	4.00	18.00	8.02	10.71	4.39	1.12**	-0.22	1.03*
FF – Attention Shifting/ Inhibitory Control	Grade 6	5.53	1.25	3.85	1.43	4.93	1.51	-1.25**	-0.44	-0.70
	Grade 7	6.10	1.33	3.91	1.68	5.25	1.61	-1.47**	-0.58	-0.77
	Grade 8	7.26	1.92	5.30	2.25	6.40	2.30	-0.94*	-0.42	-0.46
Simon – Inhibitory Control	Grade 6	6.28	1.44	3.88	1.41	5.94	1.09	-1.63***	-0.24	-1.51**
	Grade 7	6.80	0.87	5.19	1.69	5.38	1.76	-1.33**	-1.20*	-0.11
	Grade 8	7.13	0.43	5.91	1.27	6.71	0.65	-1.51***	-0.83	-0.71*
BDS – Working Memory	Grade 6	4.28	0.81	3.52	0.74	4.16	1.03	-0.94*	-0.14	-0.69
	Grade 7	4.57	0.91	3.39	0.45	4.49	0.50	-1.43***	-0.09	-2.19**
	Grade 8	5.06	0.95	3.48	0.54	4.70	0.36	-1.81***	-0.41	-2.47**

\**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

need of intervention. Together, our findings have implications for the design of interventions for Spanish-English bilingual students with reading difficulties and the identification of students who will struggle with reading comprehension throughout early adolescence into high school.

### **Profiles of GRD and S-RCD**

#### **Oral language**

Our findings add to the wealth of research highlighting the importance of language comprehension for literacy in bilingual children (Edyburn et al., 2017; Gonzalez et al., 2016; Hammer et al., 2014). We generally found significant and practically meaningful differences in vocabulary and listening comprehension between readers with either S-RCD or GRD and average readers, with large Cohen's *d* effect sizes for the GRD group compared to average readers, and medium-to-large effects for the S-RCD group compared to average readers (Cohen, 1992). Except for readers with S-RCD relative to average readers on the PPVT-4 in Grade 7, these findings emerged from each of Grades 6–8 and held when considering differences among persistently defined groups. These findings indicate that language comprehension may be a necessary component of intervention for bilingual students with GRD beyond just building decoding skills (Baker et al., 2014). Recent intervention work on upper elementary bilingual readers with low English reading comprehension with promising results has sought to center a language-based approach to target aspects of language comprehension related to the academic register of school-based texts (Proctor et al., 2019). However, our findings also dovetail with prior research indicating that oral language challenges do not fully explain their comprehension difficulties of bilingual children with S-RCD (Taboada Barber et al., 2020; Spencer & Wagner, 2017). Indeed, motivated by Kim's Direct and Indirect Effects Model of Reading (2017, 2020), we explored other domains like oral reading fluency posited to directly contribute to reading comprehension. As we detail below, our findings indicate additional differences for readers with S-RCD in this domain. Thus, further research and interventions will need to examine how to incorporate oral language instructions for bilingual adolescents with reading difficulties, but also incorporate other domains that might explain these difficulties.

#### **Reading fluency**

Our findings support the distinction between passage and word fluency observed in previous research on students entering adolescence (Geva & Farnia, 2012) and supported by Kim's (2020) Direct and Indirect Effects Model of Reading. For word reading fluency, we found children with GRD performed significantly and meaningfully worse than the other two groups, but that children with S-RCD were not significantly different than average readers, except in Grade 7 when persistently defined. However, on passage fluency we found that Spanish-English bilingual students with S-RCD performed significantly worse than average readers, but significantly better than readers with GRD (in each grade and when persistently defined), with large Cohen's *d* effect sizes between all groups. Our passage fluency finding converges with prior research with monolingual children (Cutting et al., 2009), and indicates that students with S-RCD may have difficulty coordinating multiple cognitive processes necessary for contextual reading fluency. Indeed, a study on English monolingual students has found improved contextual fluency for students with S-RCD who receive training in cognitive flexibility to help with the coordination of these reading processes (Cartwright et al., 2019). Kim's (2017, 2020) model argues that text reading fluency mediates the relations of listening comprehension and word reading to reading comprehension. Thus, although children with S-RCD do possess adequate decoding, our results suggest this is not sufficient for adequate passage fluency, and may be a contributor to their comprehension difficulties. Given the complexity of reading connected text for monolingual (Fuchs et al., 2001; Kuhn &

Stahl, 2003) and multilingual students (Crosson & Lesaux, 2010), continuing to explore passage fluency as another source of reading difficulties will prove invaluable in providing intervention. Furthermore, our findings indicate that passage fluency measures may be useful in screening for reading difficulties in Spanish-English bilingual adolescent students.

### ***Executive functions***

We found significant difficulties for children with GRD relative to average readers on almost all executive function tasks, with the only nonsignificant difference for both cross-sectional and persistently defined groups occurring on the Grade 7 Wisconsin Card Sorting task. These differences were practically meaningful with medium to large Cohen's  $d$  effect sizes between cross-sectional and persistently defined groups in Grades 6–8. Evidence and theoretical models suggest that executive functions contribute indirectly to reading comprehension via word reading, indicating that this may be a source of difficulty for children with GRD (Arrington et al., 2014; Kieffer et al., 2013; Kim, 2017; Kim, 2020). Additionally, recent research suggests that executive functions may influence classroom behavior, in turn impacting development of literacy (Dittman, 2016; Johnson et al., 2020). Thus, designing classroom structures that accommodate the executive function difficulties of students with GRD will be essential for successful instruction. Prior promising research on elementary-aged children has sought to improve their executive functions through supports embedded in reading instruction (Cartwright et al., 2020), with evidence of near transfer to executive functions and far transfer to reading comprehension. Similar work targeting areas of need for adolescents with GRD while training executive functions may be necessary. Further literature on executive functions suggests that educators can also reduce executive function demands with scaffolding practices like note writing, or by reducing general burdens on executive functions like stress and sleep loss (Diamond & Ling, 2020). Together, this research suggests that the executive function difficulties of children with GRD should be acknowledged and considered for successful intervention and education practices. In contrast to prior research on monolinguals (Cartwright et al., 2017; Cutting et al., 2009; Locascio et al., 2010), we observed very little evidence of executive function difficulties for children with S-RCD relative to average readers. However, our findings dovetail with other research including recent work that finds no differences between bilingual average readers and readers with S-RCD (Geva & Massey-Garrison, 2013; Taboada Barber et al., 2020). Given our small sample sizes and relatedly limited statistical power, we are wary of overinterpreting our null results. Nonetheless, these findings raise the possibility that bilingual readers with S-RCD may demonstrate less difficulty with executive functions than expected.

### ***Logitudinal persistence of reading difficulties in early adolescence***

Our findings on the persistence of reading difficulties for Spanish-English bilinguals in early adolescence do positively indicate that about half (52%) of students initially identified with a reading difficulty in Grade 6 exit their group by Grade 8. Compared to recent work examining the persistence of S-RCD for Spanish-English bilingual elementary aged children (Taboada Barber et al., 2020), we found a slightly smaller, though still noteworthy, percentage (47% relative to 64%) of students persisting with S-RCD across three academic years. When comparing this group and the persistent GRD group to persistently defined average readers, we observed larger differences in the same direction as the cross-sectional results. Together, these findings indicate that this smaller group of readers with persistent difficulties may need intensive intervention support when beginning high school. Further, though our longitudinal groups did decrease over time, indicating growth out of comprehension difficulties, we did observe similarly sized cross-sectional groups at each of the three grades. Thus, while some students who initially struggle do demonstrate growth,



others may lag developmental expectations and require additional instructional support despite earlier academic success. Together, these findings point to the need for early identification of bilingual students with reading difficulties and academic supports across the middle school years.

### **Limitations and future research**

While our study yields new insights into the linguistic, reading, and cognitive profiles of Spanish-English students with S-RCD and GRD, we have limitations that raise the need for future research. First, although much of the research on S-RCD and GRD relies on the use of cut-scores for identification, a body of work argues that this approach poses limitations and potential for Type I error (DeCoster et al., 2009; MacCallum et al., 2002). When researchers dichotomize a continuous variable to identify reading difficulties, they will likely find differences between groups on correlated continuous variables even if the groups are not meaningful. Additionally, we conduct a high number of regressions to test for differences, raising the potential for Type I error. However, we mitigate this limitation by looking across times and measures to identify consistent patterns of difficulties and focusing on effect sizes to evaluate when there are large and meaningful differences between groups. Nevertheless, this limitation reflects the need for future research to determine the criteria for identifying S-RCD and GRD beyond reliance on cut-scores. Furthermore, out of our sample, 50 students could not be placed in persistently defined groups either because their reading comprehension or word reading scores varied over time. This difficulty likely stems from real growth and change occurring as children progress through school, as prior research has found that bilingual students demonstrate faster rates of reading growth during adolescence than their monolingual peers (Kieffer, 2011), but in part may be due to measurement error. Regardless, future research should investigate the changes in reading profiles during adolescence to determine whose profiles change and why. The resulting small sample sizes prevented us from performing multivariate regressions to look at the unique contribution of predictors of persistent classification. In addition, we did not observe differences that can fully explain the comprehension difficulties of students with S-RCD, highlighting the need for future research on other areas like motivation or ecological factors that may contribute to these difficulties. Finally, while our study explores S-RCD in a multilingual population, we are limited in only exploring reading and language over time in English. Future research on S-RCD and GRD in multilingual populations should explore the distinctions between reading difficulties for the different languages of multilingual students, particularly for students with reading experience in multiple languages.

### **Conclusion**

Our study adds to both the body of literature exploring reading difficulties and the process of English reading acquisition in bilingual students. We found that students with S-RCD and GRD demonstrate significant challenges with passage fluency and language comprehension relative to average readers, and that readers with GRD performed significantly worse on passage fluency relative to readers with S-RCD. These findings indicate that oral language and fluency should be considered in instruction and intervention design for bilingual adolescents with reading difficulties. We also found significant difficulties for children with GRD relative to average readers on measures of executive functions tapping into attention shifting, working memory, and inhibitory control. These findings have direct implications for teachers and interventionists seeking to design instructional settings for bilingual students with GRD, as these students may need additional support in maintaining attention. Furthermore, these findings generally remained when looking at differences among persistently defined groups, representing one of the first utilizations of longitudinal data to define reading difficulties. Finally, we found that 47% of students with S-RCD and 56% of students with GRD in Grade 6 remain with this profile by the end of middle school,

indicating the need for more extensive intervention to ensure these students are ready for the demands of high school reading. Understanding how these different areas of difficulties coordinate in the reading process and how best to understand the roots of both S-RCD and GRD for all populations will prove invaluable for providing successful intervention for these students.

## Funding

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305B140037 to New York University. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education. This research was also supported by a Spencer Foundation/National Academy of Education Postdoctoral Fellowship and a New York University Research Challenge Fund grant, both awarded to Michael J. Kieffer.

## ORCID

Andrew Weaver  <http://orcid.org/0000-0002-2278-0517>

Michael J. Kieffer  <http://orcid.org/0000-0001-8000-7832>

## References

- Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207–245. <https://doi.org/10.3102/0034654310368803>
- Arrington, C. N., Kulesz, P. A., Francis, D. J., Fletcher, J. M., & Barnes, M. A. (2014). The contribution of attentional control and working memory to reading comprehension and decoding. *Scientific Studies of Reading, 18*(5), 325–346. <https://doi.org/10.1080/10888438.2014.902461>
- August, D., & Shanahan, T. (Eds.). (2006). *Developing literacy in second-language learners: Report of the National Literacy Panel on language-minority children and youth*. Lawrence Erlbaum Associates Publishers.
- Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. H. Bower (Ed.), *Psychology of Learning and Motivation* (Vol. 8, pp. 47–89). Academic Press.
- Baker, S., Lesaux, N., Jayanthi, M., Dimino, J., Proctor, C. P., Morris, J., & Newman-Gonchar, R. (2014). *Teaching academic content and literacy to English learners in elementary and middle school (No. 4012)*. National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. [http://ies.ed.gov/ncee/wwc/publications\\_reviews.aspx](http://ies.ed.gov/ncee/wwc/publications_reviews.aspx).
- Bialystok, E. (2005). Consequences of bilingualism for cognitive development. In J. F. Kroll & A. M. B. de Groot (Eds.), *Handbook of bilingualism: Psycholinguistic approaches* (pp. 417–432). Oxford University Press.
- Bialystok, E., Craik, F. I. M., Klein, R., & Viswanathan, M. (2004). Bilingualism, aging, and cognitive control: Evidence from the Simon Task. *Psychology and Aging, 19*(2), 290–303. <https://doi.org/10.1037/0882-7974.19.2.290>
- Blair, C., & Raver, C. C. (2014). Closing the achievement gap through modification of neurocognitive and neuroendocrine function: Results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten. *PLOS One, 9*(11), e112393. <https://doi.org/10.1371/journal.pone.0112393>
- Cain, K., & Oakhill, J. (2006). Profiles of children with specific reading comprehension difficulties. *The British Journal of Educational Psychology, 76*(Pt 4), 683–696. <https://doi.org/10.1348/000709905X67610>
- Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science, 11*(2), 282–298. <https://doi.org/10.1111/j.1467-7687.2008.00675.x>
- Cartwright, K. B., Bock, A. M., Clause, J. H., Coppage August, E. A., Saunders, H. G., & Schmidt, K. J. (2020). Near- and far-transfer effects of an executive function intervention for 2nd to 5th-grade struggling readers. *Cognitive Development, 56*, 100932. <https://doi.org/10.1016/j.cogdev.2020.100932>
- Cartwright, K. B., Coppage, E. A., Lane, A. B., Singleton, T., Marshall, T. R., & Bentivegna, C. (2017). Cognitive flexibility deficits in children with specific reading comprehension difficulties. *Contemporary Educational Psychology, 50*, 33–44. <https://doi.org/10.1016/j.cedpsych.2016.01.003>
- Cartwright, K. B., Marshall, T. R., Huemer, C. M., & Payne, J. B. (2019). Executive function in the classroom: Cognitive flexibility supports reading fluency for typical readers and teacher-identified low-achieving readers. *Research in Developmental Disabilities, 88*, 42–52. <https://doi.org/10.1016/j.ridd.2019.01.011>

- Catts, H. W., Hogan, T. P., & Fey, M. E. (2003). Subgrouping poor readers on the basis of individual differences in reading-related abilities. *Journal of Learning Disabilities, 36*(2), 151–164. <https://doi.org/10.1177/002221940303600208>
- Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159. <https://doi.org/10.1037/0033-2909.112.1.155>
- Crosson, A. C., & Lesaux, N. K. (2010). Revisiting assumptions about the relationship of fluent reading to comprehension: Spanish-speakers' text-reading fluency in English. *Reading and Writing, 23*(5), 475–494. <https://doi.org/10.1007/s11145-009-9168-8>
- Cutting, L. E., Materek, A., Cole, C. A. S., Levine, T. M., & Mahone, E. M. (2009). Effects of fluency, oral language, and executive function on reading comprehension performance. *Annals of Dyslexia, 59*(1), 34–54. <https://doi.org/10.1007/s11881-009-0022-0>
- Cutting, L. E., & Scarborough, H. S. (2006). Prediction of reading comprehension: Relative contributions of word recognition, language proficiency, and other cognitive skills can depend on how comprehension is measured. *Scientific Studies of Reading, 10*(3), 277–299. [https://doi.org/10.1207/s1532799xssr1003\\_5](https://doi.org/10.1207/s1532799xssr1003_5)
- de Bruin, A., Treccani, B., & Della Sala, S. (2015). Cognitive advantage in bilingualism: An example of publication bias? *Psychological Science, 26*(1), 99–107. <https://doi.org/10.1177/0956797614557866>
- DeCoster, J., Iselin, A.-M. R., & Gallucci, M. (2009). A conceptual and empirical examination of justifications for dichotomization. *Psychological Methods, 14*(4), 349–366. <https://doi.org/10.1037/a0016956>
- Diamond, A., Barnett, W. S., Thomas, J., & Munro, S. (2007). Preschool program improves cognitive control. *Science (New York, N.Y.), 318*(5855), 1387–1388. <https://doi.org/10.1126/science.1151148>
- Diamond, A., & Ling, D. S. (2020). Review of the evidence on, and fundamental questions surrounding efforts to improve executive functions, including working memory. In J. M. Novick, M. F. Bunting, M. R. Dougherty, & R. W. Engle (Eds.), *Cognitive and working memory training: Perspectives from psychology, neuroscience, and human development*. Oxford University Press.
- Dick, A. S., Garcia, N. L., Pruden, S. M., Thompson, W. K., Hawes, S. W., Sutherland, M. T., Riedel, M. C., Laird, A. R., & Gonzalez, R. (2019). No evidence for a bilingual executive function advantage in the nationally representative ABCD study. *Nature Human Behaviour, 3*(7), 692–701. <https://doi.org/10.1038/s41562-019-0609-3>
- Dittman, C. K. (2016). The impact of early classroom inattention on phonological processing and word-reading development. *Journal of Attention Disorders, 20*(8), 653–664. <https://doi.org/10.1177/1087054713478979>
- Duke, N.K., & Cartwright, K.B. (2019). The DRIVE model of reading: Deploying reading in varied environments. In D.E. Alvermann, N.J. Unrau, M. Sailors, & R.B. Ruddell (Eds.), *Theoretical models and processes of literacy* (7th ed., pp. 118–135). New York, NY: Routledge.
- Dunn, L., & Dunn, L. (1997). *Peabody picture vocabulary test* (4th ed.) American Guidance Service.
- Dunn, L. M., Padilla, E. R., Lugo, D. E., & Dunn, L. M. (1986). *Test de vocabulario en imagenes Peabody* [Peabody picture vocabulary test]: Adaptación Hispanoamericana [Hispanic American adaptation]. American Guidance Service.
- Edyburn, K. L., Quirk, M., Felix, E., Swami, S., Goldstein, A., Terzieva, A., & Scheller, J. (2017). Literacy screening among Latino/a and dual language learner kindergarteners: Predicting first grade reading achievement. *Literacy Research and Instruction, 56*(3), 250–267. <https://doi.org/10.1080/19388071.2017.1305470>
- Etmanskie, J. M., Partanen, M., & Siegel, L. S. (2016). A longitudinal examination of the persistence of late emerging reading disabilities. *Journal of Learning Disabilities, 49*(1), 21–35. <https://doi.org/10.1177/0022219414522706>
- Fuchs, L. S., Fuchs, D., Hosp, M. K., & Jenkins, J. R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading, 5*(3), 239–256. [https://doi.org/10.1207/S1532799XSSR0503\\_3](https://doi.org/10.1207/S1532799XSSR0503_3)
- Geva, E., & Farnia, F. (2012). Developmental changes in the nature of language proficiency and reading fluency paint a more complex view of reading comprehension in ELL and EL1. *Reading and Writing, 25*(8), 1819–1845. <https://doi.org/10.1007/s11145-011-9333-8>
- Geva, E., & Massey-Garrison, A. (2013). A comparison of the language skills of ELLs and monolinguals who are poor decoders, poor comprehenders, or normal readers. *Journal of Learning Disabilities, 46*(5), 387–401. <https://doi.org/10.1177/0022219412466651>
- Gonzalez, J., Pollard-Durodola, S., Saenz, L., Soares, D., Davis, H., Resendez, N., & Zhu, L. (2016). Spanish and English early literacy profiles of preschool Latino English language learner children. *Early Education and Development, 27*(4), 513–531. <https://doi.org/10.1080/10409289.2015.1077038>
- Good, R. H., & Kaminski, R. A. (Eds.). (2002). *Dynamic indicators of basic early literacy skills* (6th ed.). Institute for the Development of Educational Achievement. <http://dibels.uoregon.edu/>
- Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education, 7*(1), 6–10. <https://doi.org/10.1177/074193258600700104>
- Hammer, C. S., Hoff, E., Uchikoshi, Y., Gillanders, C., Castro, D., & Sandilos, L. E. (2014). The language and literacy development of young dual language learners: A critical review. *Early Childhood Research Quarterly, 29*(4), 715–733. <https://doi.org/10.1016/j.ecresq.2014.05.008>

- Johnson, K. A., White, M., Wong, P. S., & Murrihy, C. (2020). Aspects of attention and inhibitory control are associated with on-task classroom behaviour and behavioural assessments, by both teachers and parents, in children with high and low symptoms of ADHD. *Child Neuropsychology*, 26(2), 219–241. <https://doi.org/10.1080/09297049.2019.1639654>
- Keenan, J. M., Betjemann, R. S., & Olson, R. K. (2008). Reading comprehension tests vary in the skills they assess: Differential dependence on decoding and oral comprehension. *Scientific Studies of Reading*, 12(3), 281–300. <https://doi.org/10.1080/10888430802132279>
- Kieffer, M. J. (2011). Converging trajectories: Reading growth in language minority learners and their classmates, kindergarten to grade eight. *American Educational Research Journal*, 48(5), 1187–1186. <https://doi.org/10.3102/0002831211419490>
- Kieffer, M. J., Mancilla-Martinez, J., & Logan, J. K. (2021). Executive functions and English reading comprehension growth in Spanish-English bilingual adolescents. *Journal of Applied Developmental Psychology*, 73, 101238. <https://doi.org/10.1016/j.appdev.2021.101238>
- Kieffer, M. J., Vukovic, R. K., & Berry, D. (2013). Roles of attention shifting and inhibitory control in fourth-grade reading comprehension. *Reading Research Quarterly*, 48(4), 333–348. <https://doi.org/10.1002/rrq.54>
- Kim, Y.-S G. (2017). Why the simple view of reading is not simplistic: Unpacking component skills of reading using a direct and indirect effect model of reading (dier). *Scientific Studies of Reading*, 21(4), 310–333. <https://doi.org/10.1080/10888438.2017.1291643>
- Kim, Y.-S G. (2020). Toward integrative reading science: The direct and indirect effects model of reading. *Journal of Learning Disabilities*, 53(6), 469–491. <https://doi.org/10.1177/0022219420908239>
- Kongs, S. K., Thompson, L. L., Iverson, G. L., & Heaton, R. K. (2000). *Wisconsin card sorting test-64 card version*. PAR Incorporated.
- Kintsch, W. (1998). *Comprehension: A paradigm for cognition*. New York: Cambridge University Press.
- Kuhn, M. R., & Stahl, S. A. (2003). Fluency: A review of developmental and remedial practices. *Journal of Educational Psychology*, 95(1), 3–21. <https://doi.org/10.1037/0022-0663.95.1.3>
- LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology*, 6(2), 293–323. [https://doi.org/10.1016/0010-0285\(74\)90015-2](https://doi.org/10.1016/0010-0285(74)90015-2)
- Landi, N., & Ryherd, K. (2017). Understanding specific reading comprehension deficit: A review. *Language and Linguistics Compass*, 11(2), e12234–24. <https://doi.org/10.1111/lnc3.12234>
- Lesaux, N. K., Crosson, A. C., Kieffer, M. J., & Pierce, M. (2010). Uneven profiles: Language minority learners' word reading, vocabulary, and reading comprehension skills. *Journal of Applied Developmental Psychology*, 31(6), 475–483. <https://doi.org/10.1016/j.appdev.2010.09.004>
- Lesaux, N. K., & Kieffer, M. J. (2010). Exploring sources of reading comprehension difficulties among language minority learners and their classmates in early adolescence. *American Educational Research Journal*, 47(3), 596–632. <https://doi.org/10.3102/0002831209355469>
- Li, M., & Kirby, J. R. (2014). Unexpected poor comprehenders among adolescent ESL students. *Scientific Studies of Reading*, 18(2), 75–93. <https://doi.org/10.1080/10888438.2013.775130>
- Locascio, G., Mahone, E. M., Eason, S. H., & Cutting, L. E. (2010). Executive dysfunction among children with reading comprehension deficits. *Journal of Learning Disabilities*, 43(5), 441–454. <https://doi.org/10.1177/0022219409355476>
- MacCallum, R. C., Zhang, S., Preacher, K. J., & Rucker, D. D. (2002). On the practice of dichotomization of quantitative variables. *Psychological Methods*, 7(1), 19–40. <https://doi.org/10.1037/1082-989x.7.1.19>
- MacGinitie, W., MacGinitie, R., Maria, K., & Dreyer, L. G. (2002). *Gates-MacGinitie reading test* (4th ed.). Riverside Publishing Company.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology*, 41(1), 49–100. <https://doi.org/10.1006/cogp.1999.0734>
- New York State Education Department. (2015). *New York State testing program 2015: English language arts and Mathematics Grades 3–8*. <http://www.p12.nysed.gov/assessment/reports/ei/tr38-15w.pdf>
- Paap, K. R., Johnson, H. A., & Sawi, O. (2015). Bilingual advantages in executive functioning either do not exist or are restricted to very specific and undetermined circumstances. *Cortex*, 69, 265–278. <https://doi.org/10.1016/j.cortex.2015.04.014>
- Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental Psychopathology. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 37(1), 51–87. <https://doi.org/10.1111/j.1469-7610.1996.tb01380.x>
- Potocki, A., Sanchez, M., Ecalle, J., & Magnan, A. (2017). Linguistic and cognitive profiles of 8- to 15-year-old children with specific reading comprehension difficulties: The role of executive functions. *Journal of Learning Disabilities*, 50(2), 128–142. <https://doi.org/10.1177/0022219415613080>

- Proctor, C. P., Carlo, M., August, D., & Snow, C. (2005). Native Spanish-speaking children reading in English: Toward a model of comprehension. *Journal of Educational Psychology*, 97(2), 246–256. <https://doi.org/10.1037/0022-0663.97.2.246>
- Proctor, C. P., Silverman, R. D., Harring, J. R., Jones, R. L., & Hartranft, A. M. (2019). Teaching bilingual learners: Effects of a language# based reading intervention on academic language and reading comprehension in grades 4 and 5. *Reading Research Quarterly*, 55(1), 95–122. <https://doi.org/10.1002/rrq.258>
- Samuels, S. J. (2006). Toward a model of reading fluency. In S. J. Samuels & A. E. Farstrup (Eds.), *What research has to say about fluency instruction* (p. 24–46). International Reading Association.
- Sesma, H. W., Mahone, E. M., Levine, T., Eason, S. H., & Cutting, L. E. (2009). The contribution of executive skills to reading comprehension. *Child Neuropsychology*, 15(3), 232–246. <https://doi.org/10.1080/09297040802220029>
- Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content- area literacy. *Harvard Educational Review*, 78(1), 40–59. <https://doi.org/10.17763/haer.78.1.v62444321p602101>
- Slotkin, J., Nowinski, C., Hays, R., Beaumont, J., Griffith, J., Magasi, S., & Gershon, R. (2012). *NIH Toolbox scoring and interpretation guide*. National Institutes of Health.
- Spencer, M., & Wagner, R. K. (2017). The comprehension problems for second-language learners with poor reading comprehension despite adequate decoding: A meta-analysis: Meta-analysis of second-language learners. *Journal of Research in Reading*, 40(2), 199–217. <https://doi.org/10.1111/1467-9817.12080>
- Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 21(4), 360–407. <https://doi.org/10.1598/RRQ.21.4.1>
- Swanson, H. L., & Siegel, L. (2001). Learning disabilities as a working memory deficit. *Issues in Education: Contributions from Educational Psychology*, 7(1), 1–48.
- Taboada Barber, A., Klauda, S. L., Wang, W., Cartwright, K. B., & Cutting, L. E. (2020). Emergent bilinguals with specific reading comprehension deficits: A comparative and longitudinal analysis. *Journal of Learning Disabilities*. 002221942098324. <https://doi.org/10.1177/0022219420983247>
- Takanishi, R., & Menestrel, S. L. (Eds.). (2017). *Promoting the educational success of children and youth learning English: Promising futures*. The National Academies Press.
- Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (2012). *Test of word reading efficiency* (2nd ed.). Pro-Ed.
- Wechsler, D. (1939). *Wechsler-Bellevue intelligence scale*. The Psychological Corporation.
- Williams, K. T. (2002). *Group reading assessment and diagnostic evaluation*. Pearson.
- Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). *Woodcock-Johnson<sup>®</sup> III test*. Riverside Publishing Company.
- Woodcock, R. W., Muñoz-Sandoval, A. F., Ruef, M. L., & Alvarado, C. G. (2005). *Woodcock-Muñoz language survey-revised*. Riverside.
- Woods, D. L., Kishiyama, M. M., Lund, E. W., Herron, T. J., Edwards, B., Poliva, O., Hink, R. F., & Reed, B. (2011). Improving digit span assessment of short-term verbal memory. *Journal of Clinical and Experimental Neuropsychology*, 33(1), 101–111. <https://doi.org/10.1080/13803395.2010.493149>