

Improving Expository Text Comprehension in Adolescent Spanish-English Bilingual
Learners with Learning Disabilities using a Graphic Organizer

by

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ABSTRACT

The purpose of this single case design study was to examine the efficacy of a graphic organizer for improving the reading comprehension of middle school Spanish-English bilingual middle school students with learning disabilities. Students included two females and one male student. Using a multiple baseline across participants design, students were taught to create a funnel map graphic organizer for 10 descriptive text passages. Students' performance was assessed on their ability to correctly create the funnel map (criterion variable) and to comprehend the expository passages during baseline, intervention, and maintenance phases. Each participant learned to create an accurate funnel map for descriptive texts within four sessions. Reading comprehension scores began to increase within three intervention sessions for each participant. Results showed the positive effect of using the funnel map to improve reading comprehension of descriptive texts. Individual TAU effect sizes (.81 to .92) and overall TAU-U effect sizes (.86) and a Between Cases Standardized Mean Difference (BC-SMD) of 1.87 showed the intervention to be highly effective. Based on the effect sizes, the funnel map was effective for improving the reading comprehension of middle school Spanish-English bilingual students with learning disabilities.

DEDICATION

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TABLE OF CONTENTS

	Page
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
CHAPTER	
1 INTRODUCTION.....	1
Theoretical Framework of Reading Comprehension.....	3
Interventions for Reading Comprehension.....	4
Reading Comprehension Interventions for Bilingual Learners.....	5
Reading Comprehension Interventions for Students with Disabilities.....	10
Graphic Organizers and Reading Comprehension.....	20
Rationale.....	23
Purpose and Research Questions.....	24
References.....	26
2 MANUSCRIPT.....	31
Introduction.....	31
Method.....	41
Results.....	55
Discussion.....	60
References.....	66

APPENDIX	Page
A TABLES.....	74
B FIGURES.....	79
C ARIZONA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD...	85
D READING PASSAGE SAMPLE.....	89
E MAIN IDEA.....	91
F READING COMPREHENSION ASSESSMENT SAMPLE.....	93
G SOCIAL VALIDTY SURVEY.....	96
H FIDELITY CHECKLIST.....	99
I LESSON PLAN.....	101

LIST OF TABLES

Table	Page
1. Family Demographics.....	74
2. Descriptive Statistics.....	75
3. Descriptive Statistics for Baseline Measures Reading Passages.....	76
4. Descriptive Statistics for Intervention Measures Reading Passages.....	77
5. Funnel Map & Comprehension Outcome Variables and Individual Effect Sizes.....	78

LIST OF FIGURES

Figure	Page
1. Funnel Map Example.....	80
2. Percentage Correct of Funnel Map and Reading Comprehension Means	81
3. Visual Analysis of Intervention Effects.....	82
4. Percentage Correct of Key Details and Main Idea Means	83
5. Percentage Correct of Literal and Inferential Questions Means.....	84

Improving Expository Text Comprehension in Adolescent Spanish-English Bilingual Learners using a Graphic Organizer

The reading proficiency of Spanish-English bilingual learners with learning disabilities (LD) is of high concern for both educators and researchers. According to the National Assessment for Education Progress (NAEP; National Center for Education Statistics (NCES), 2019a), 96 percent of bilingual learners and 91 percent of students with disabilities in eighth grade were reading below proficient levels on national assessments of reading. On the 2019 NAEP reading assessment, bilingual learners scored 221 and students with disabilities scored 229, with 280 considered ‘proficient.’ While NAEP did not report the number of Spanish-English bilingual learners with LD reading at proficiency, they did report that 78 percent of Hispanic students were reading below proficient levels compared to 58 percent of their White peers.

The population of bilingual learners in the United States has increased over the last two decades. Since 2000, the percentage of Spanish-English bilingual students increased from 16 percent to 25 percent (NCES, 2019b). In 2015, 4.9 million children whose heritage language was one other than English attended public schools in the United States and of that number, 77 percent spoke Spanish as their heritage language (NCES, 2019a). In the 2018-19 school year, the number of Spanish-English bilingual learners in public schools who received special education services approached one million (NCES, February 2020; NCES, 2020). Of these children, over 740,000 were identified as having a specific learning disability. Because of the increasing population of

bilingual learners, our attention must focus on how to provide them with the tools and supports to comprehend written texts.

Reading comprehension is arguably the most important skill for children to develop as they progress through their formal education. However, many adolescent bilingual students with LD struggle with reading comprehension in the late elementary and middle grades as they encounter different text structures (Lesaux & Kieffer, 2010, Li, et al. 2020) and the demand for more complex oral language skills, vocabulary, and background knowledge (Farnia & Geva, 2013) increases. Moreover, adolescent bilingual learners with LD often lag behind in the development of these complex skills in their second language (Grimm et al., 2018; Kieffer, 2012; Lesaux & Kieffer, 2010). Because many adolescent bilingual learners with LD have poor reading comprehension, they are at risk for academic failure (Fagella-Luby & Deshler, 2008; Richman et al., 1998) and at risk for dropping out of school (Vaughn et al. 2015).

Because of the importance of reading comprehension, this study focused on a reading comprehension intervention using expository texts for Spanish-English bilingual students with LD at the middle school level. Expository texts become increasingly important in elementary school as students shift to reading for learning purposes. Moreover, expository texts are more difficult to comprehend because they contain new and abstract concepts, complex relationships among concepts, and less familiar text structures (Kraal et al., 2018; Meyer & Ray, 2011). As students enter the middle grades, content area educators expect students to be able to understand complex grade level expository texts. However, many bilingual students with LD struggle with reading

comprehension of expository texts (Lesaux et al., 2010; Mancilla-Martinez & Lesaux, 2010).

Theoretical Underpinnings of Reading Comprehension Interventions

Reading comprehension is one of the most complex processes that students engage in over the course of their academic career. Researchers have wrestled with how to best define and operationalize the construct of reading comprehension. A theoretical model pertaining directly to the present study is the Direct and Inferential Mediation Model of Reading Comprehension (DIME). Cromley and Azevedo (2007) posited that a set of factors, including background knowledge, vocabulary, strategies (i.e., summarizing, self-questioning, using story structures, or using graphic organizers), inference, and word reading, result in reading comprehension. Given that adolescents who struggle with reading comprehension often lack background knowledge and vocabulary, use strategies inaccurately, struggle with inferencing, and may have slow or inaccurate word reading, the researchers hypothesized background knowledge and vocabulary would have a direct effect on reading comprehension. Further, they believed that background knowledge and vocabulary would have a direct effect on inference, as well as inference would have a direct effect on reading comprehension. Finally, they hypothesized that strategies may have a direct effect on both reading comprehension and inference and word reading a direct on reading comprehension.

In their investigation of the DIME model, Cromley and Azevedo (2007) collected measures of reading comprehension, background knowledge, inference, strategies, vocabulary, and word reading on 177 racially diverse ninth grade students (28% White,

27% Black, 23% Hispanic, 14% Asian, and 8% mixed race). Results of the study indicated that all paths in the model were statistically significant with the exception of the direct effect of strategies on reading comprehension. In fact, background knowledge (.234) and vocabulary (.366) had the strongest direct effects on reading comprehension. While strategies did not have a significant effect on reading comprehension, it did have a significant effect on inference (.516) and a mediated effect on reading comprehension via inference (.099). The results of this study suggest that vocabulary and background knowledge are key contributors to reading comprehension and that strategies may support students in creating inferences and indirectly support reading comprehension. Given the results, interventions that target background knowledge, vocabulary and strategies may prove efficacious for adolescents who struggle with reading comprehension are warranted. In fact, many researchers have developed and tested multiple and single component interventions and found positive results (see review below).

Interventions for Reading Comprehension

The National Reading Panel (2000) posited that reading comprehension can be improved by teaching students to use specific strategies when they encounter obstacles to comprehension when they read. The NRP outlined several strategies that are effective in helping students access written text including cooperative learning, multiple strategies, questioning, text structure, summarization, and graphic organizers. Given the majority of reading comprehension intervention studies targeted monolingual general education students who were performing below grade level expectations, the depth of research available on adolescent bilingual learners with LD is limited. Because of the dearth of

research for this population, studies that include bilingual learners and students with LD is reviewed.

Reading Comprehension Interventions for Bilingual Learners

While the research on effective reading comprehension interventions for bilingual learners is still growing (Tachoad-Barber, et al., 2015), five studies were identified that sought to improve reading comprehension of bilingual learners using strategies in intermediate, middle, and early high school grades. Researchers examined interventions using multiple strategies (vocabulary, background knowledge, questioning, and cooperative learning) to improve the reading comprehension of Spanish-English bilingual learners ranging from fourth through ninth grades (Tong et al., 2014; Vaughn et al, 2017; Vaughn, et al., 2009; Wanzek & Roberts, 2012; Wijekumar et al., 2018)

Multiple Component. Tong et al. (2014) investigated the effects a science intervention embedded with language and reading instruction for 56 Spanish-English bilingual learners in fifth grade. Participants were randomly assigned to the treatment or control condition. Participants in the treatment condition received a science intervention using the 5-E strategy (Engage, Explore, Explain, Elaborate and Evaluate) which aligned to question stems to the five levels of Bloom's Taxonomy of hierarchical cognitive skills. Results between the treatment and control group found significant results on the district science benchmark test ($p = .049$; Cramer's $V = .372$), but did not find between group significance on state science assessment ($p = .08$; Cramer's $V = .337$). While there were not significant findings on the state assessment measure, overall findings suggested that students who received the intervention performed better on mastery of science concepts

at the district level compared to those in the control group. The authors suggested that this supports the idea that intermediate grades should focus on developing content knowledge while supporting reading comprehension. However, the authors cautioned generalizing the results to broader populations of students due to the small sample size. Future studies with more participants is needed to validate these results.

Vaughn et al. (2017) examined the efficacy of Promoting Acceleration of Comprehension and Content through Text (PACT) on the reading comprehension of 435 Spanish-English bilingual learners in seventh and eighth grades. Participants in the treatment condition engaged in background knowledge activation, vocabulary instruction, graphic organizers, critical reading, and team-based learning. During team-based learning, participants were grouped heterogeneously where they worked both individually and as a team to ensure that everyone learned and understood content. Researchers found that both bilingual learners and monolingual learners who received the treatment outperformed those assigned to the control condition on measures of content knowledge comprehension ($p < .05$; $ES = .20$). The researchers posited that team-based learning fostered high levels of discussions and the use of graphic organizer during team-based learning, which had a strong impact on knowledge acquisition and reading comprehension of participants. However, one must note that it is difficult to parse out which strategies may be the most effective at improving reading comprehension in package interventions.

Vaughn et al. (2009) looked to enhance social studies vocabulary and reading comprehension for Spanish-English bilingual in two studies using vocabulary instruction,

videos to build background knowledge, graphic organizers, and paired learning. The first study ($n = 381$) yielded statistically significant differences between treatment and control for reading comprehension ($p < .001$; $g = 1.12$) on a researcher created content-based measure. The second study ($n = 507$) resulted in statistically significant differences between treatment and control for reading comprehension on content-based measures ($p = .016$; $g = .480$). Of the four strategies used within the intervention, three focused on content knowledge acquisition and the fourth, paired learning, focused on peer interactions to extend content learning. The authors stated that it was this combination of explicit instruction in vocabulary and content area concepts and the use of structured discussions and graphic organizers by pairs of students that provided the support to improve their comprehension. While there were significant differences between groups, the authors reported that some teachers had difficulty adapting to the language needs of students and often moved on to other students instead of supporting their language needs indicating that additional training for teachers may be warranted for addressing diverse language needs.

Wanzek & Roberts (2012) examined three interventions (word recognition emphasis, reading comprehension emphasis, responsive emphasis) on the reading comprehension of 87 Spanish-English bilingual learners in fourth grade. Participants were randomly assigned to one of three treatment conditions or a control condition. Participants assigned to the word recognition condition received instruction on how to read words and apply that knowledge to text using the Wilson Reading System (Wilson, 2002). Participants in the reading comprehension condition were taught how to use the

Collaborative Strategic Reading (CSR) strategy using expository science text. In CSR, participants were taught four strategies: previewing, click and clunk, get the gist, and wrap up. During previewing, participants were instructed to brainstorm and predict prior to reading the text. Within the click and clunk strategy, participants were taught how to use strategies when they encountered words or sentences, they did not understand. During get the gist, participants identified the main idea of the paragraph or the section of the text they read. Finally, during the wrap up strategy, students generated and answered questions and reviewed the main ideas of the passage. Participants randomly assigned to the responsive condition were placed into instructional groups based on their area of deficits (word recognition or reading comprehension). Participants in the control group received intervention instruction provided by the school. Analyses showed no statistically significant differences between conditions on distal measures of reading comprehension ($p = .421$). The authors stated that due to the low sample size they lacked the power to detect significant between group differences.

Wijekumar et al. (2018) examined the use of Strategy instruction on the Web for English Learners (SWELL) on the reading comprehension of 4th and 5th grades Spanish-English bilingual learners in 28 classrooms across 12 schools using a randomized controlled study. Classrooms were randomly assigned to the SWELL condition or a business as usual condition. Participants in the SWELL condition received instructional supports for background knowledge and vocabulary, main idea identification, checks for understanding, inference making, and writing activities that allowed students to elaborate and extend reading. Researchers found statistically significant between group differences

for fourth grade ($p < .001$; $ES = .79$), but no statistically significant differences for fifth grade ($p > .05$; $ES = .47$) on standardized reading comprehension measures. Participants using SWELL also made statistically significant gains compared to participants in the control condition on proximal measures of reading in fourth grade for recall competency ($p < .05$; $ES = .69$) and in fifth grade main idea quality ($p < .001$; $ES = .77$). The authors suggested that scaffolding instruction (background and vocabulary instruction, main idea identification, etc.) for reading comprehension as well as including reading passages on high interest topics were the keys to the success of the intervention. While there were positive results, the authors stated that future studies need to include larger sample sizes and increased fidelity of implementation is needed to understand the effects of SWELL.

Summary for Bilingual Learners. The studies reviewed in this section demonstrate that multiple strategies for reading comprehension were effective in building reading comprehension of bilingual learners. The studies with the largest effect sizes included a combination of building background knowledge and vocabulary instruction with the additive effects of graphic organizers, and/or collaborative learning strategies (Vaughn et al, 2017; Vaughn, et al., 2009; Wijekumar et al., 2018). While these studies showed positive results, they are not without limitations. First, three studies lacked the power to detect statistically significant differences between groups (Tong, et al. 2014; Wanzek & Roberts, 2012; Wijekumar et al., 2018). Second, each of the studies used multiple strategies built into a packaged intervention. Because these studies included multiple components, it is not possible to discern which component was most effective at improving reading comprehension. Therefore, it is important to investigate individual

strategies in order to understand their effects on reading comprehension within fully powered studies.

Reading Comprehension Interventions for Students with LD

The research base on reading comprehension interventions for students with learning disabilities is broader than that for bilingual learners. We identified 14 studies that investigated the effects of reading comprehension using expository texts in students with LD in upper elementary, middle, and early high school grades. Researchers used a variety of interventions including collaborative learning strategies, graphic organizers, summarization, attribution retraining, goal setting, and guided reading and is discussed in detail below.

Collaborative Learning Strategies. Collaborative learning strategies build on the structure of learning that emphasizes language and communication with peers as a factor in deepening learning and content acquisition (Kent et al., 2015). Collaborative learning typically involves heterogeneous small groups of students engaging in learning activities with specific learning goals. Eight studies have examined the effects of a variety of collaborative learning strategies on the reading comprehension of students with LD (Calhoun, 2005; Fuchs et al., 1999; Kent et al., 2015; Klingner & Vaughn, 1996; Mastropieri et al., 2001; Mastropieri et al., 2003; Saenz et al., 2005; Williams & Vaughn, 2020). In the five studies reviewed, only two studies reported statistically significant differences ($g = .25$ – $g = .50$) on proximal measures of reading comprehension with small to medium effects (Fuchs et al., 1999; Mastropieri et al., 2003).

Calhoon (2005) investigated the effects of peer mediated learning on the teaching of phonics skills and reading comprehension for 38 sixth, seventh, and eighth grade students identified as having a learning disability in reading. Participants were randomly assigned to either a peer mediated learning training that focused on phonological skills, language training, and reading comprehension or to a comparison group. Participants in the treatment condition were explicitly taught phonological awareness, phonics, morphology, orthography, and reading comprehension instruction through peer assisted learning. Participants assigned to the comparison condition received traditional phonics and reading comprehension instruction with no peer assisted learning. Results indicated a large effect size for the standardized measure of reading comprehension ($p = .01$; $d = .94$). The authors noted that the small groups sizes, immediate feedback, increased opportunities to practice, and the peer learning strategies may have contributed to the large effect sizes found for reading comprehension. While significant between group differences were found, participants were not randomly assigned and were nested within teachers. Nesting of students within teachers increases the possibility of Type I error, thus, may reflect statistically significant results when in fact the results are not statistically significant.

Fuchs et al. (1999) examined the effects of peer assisted learning strategies (PALS) on the reading development of high school students with disabilities across 18 special education classrooms. Classrooms were randomly assigned to either the PALS condition ($n = 9$) or a contrast condition ($n = 9$). PALS is designed to facilitate partner reading with the opportunities to develop reading comprehension through summarization

and main idea identification (paragraph shrinking) and formulate and confirm or disconfirm predictions made about the text (prediction relay). Participants assigned to the contrast condition received traditional classroom instruction with no training in PALS. Results indicated that the PALS condition showed a small effect on reading comprehension ($p < .05$; $d = .34$) on researcher-created measures of reading comprehension. The authors posited that PALS strong emphasis on peer learning with practice in retelling, summarizing and predicting supported the participants gains in reading comprehension.

Kent et al. (2015) investigated the effectiveness of team-based learning (TBL) on social studies content acquisition of 24 eleventh grade students with learning disabilities and language disorders. Participants were randomly assigned to either the TBL treatment condition or a business as usual control condition. A key component of TBL is the creation of heterogenous groups of three to five students. During small group activities, participants engaged in collaborative discourse, which required critical thinking skills. Participants also engaged in problem solving activities that required the application of content knowledge. Results indicated no statistically significant between group differences for content knowledge ($p > .05$; $g = .50$) or reading comprehension of historical events ($p > .05$; $g = .38$). The small sample size may have resulted in low statistical power, which may have contributed to nonsignificant findings in reading comprehension.

Klingner and Vaughn (1996) investigated reciprocal teaching coupled with either cross-aged tutoring or cooperative learning to improve reading comprehension of 28

bilingual learners with learning disabilities in seventh and eighth grades. All participants engaged in reciprocal teaching training for 40 minutes daily for 15 days. Participants were then randomly assigned to the cross-aged tutoring condition or to the cooperative learning condition. The results of the between group analyses was not statistically significant on distal or proximal measures of reading comprehension. However, the pretest to posttest gains on proximal reading comprehension show statistically significant growth ($p = .001$). Researchers noted that bilingual learners who were adequate decoders, but poor comprehenders improved their reading comprehension scores from pre-intervention to post-intervention. Thus, the opportunity for students to either tutor another or participate in cooperative groups that incorporates reading comprehension strategies is an effective way for students to improve their reading comprehension. One limitation of this study was the lack of a control group. Therefore, it may not be possible to determine out the true effects of the intervention.

Mastropieri et al. (2001) examined the effectiveness of reciprocal tutoring on the reading comprehension of 24 seventh graders with learning disabilities and mild cognitive disabilities. Participants were randomly assigned to a reciprocal tutoring condition or to traditional reading instruction in the special education classroom. Participants in the reciprocal tutoring condition assumed the roles of both the tutor and the tutee during the reading period in which they would partner read for error correction and summarized the text. Participants in the control condition read the same passages as students in the treatment condition, but received no instruction on reciprocal tutoring. The results indicated that there were no statistically significant differences between the two

conditions with the overall performance being low on proximal measures of reading comprehension. The authors stated that there were several challenges with the tutoring condition. First, some participants reported that they had difficulty correcting errors during partner reading because they did not know the words themselves. Secondly, some participants reported that they did not work well with their assigned partner, Finally, participants with low reading comprehension who were paired together had difficulty helping with text summarization.

Mastropieri et al. (2003) investigated outcomes associated with peer tutoring and a guided notetaking intervention with a social studies focus on 16 high school students with learning disabilities. Participants in the peer tutoring condition received instruction on rules and procedures of working with peers, identifying, and correcting reading errors, how to summarize using a summarization sheet, and a checklist for self-monitoring. Participants in the guided notetaking received a fill-in-the-blank set of notes that accompanied each text including matching items, vocabulary, and short answer items. Results indicated significant main effects for condition favoring the tutoring condition for chapter test ($p < .01$; $ES = 2.16$) and unit test ($p < .01$; $ES = 2.25$), but not for end of year test ($p = .16$). The authors suggested that participants in the tutoring condition outperformed participants in the notetaking condition because they were actively engaged in reading, writing, asking, and answering each other's questions and this type of repetitive instruction resulted in their achievement. However, participants were not randomly assigned to conditions and were nested within a single teacher, which may have increased the possibility of a Type 1 error.

Saenz et al (2005) examined the effects of Peer Assisted Learning Strategies (PALS) on the reading comprehension of 132 Spanish-English bilingual learners with LD in third through sixth grades in 12 classrooms. Classrooms were randomly assigned to PALS or a control condition. Participants in the PALS condition engaged in reciprocal tutoring that included partner reading, summarizing paragraphs, and making predictions while the control condition received business as usual instruction in the regular classroom. Results showed statistically significant differences between groups for proximal measures of reading comprehension ($p < .01$; $ES = 1.02$), but not for the proximal maze measure ($p > .05$; $ES = .40$), a measure of fluency and reading comprehension. Because randomization occurred at the teacher level ($n = 12$), which resulted in low statistical power, may have resulted in a lack of statistically significant treatment effects for student type interactions.

Williams and Vaughn (2020) investigated the effects of Collaborative Strategic Reading (CSR) on the reading comprehension of 89 Spanish-English bilingual learners with LD. In the yearlong study, participants went through two phases of interventions. The first phase focused on word studies, fluency, vocabulary, and reading comprehension through CSR. The second phase of the intervention targeted activating and building prior knowledge, key academic vocabulary and allowing students to interact with texts to foster a deep understanding of content. Participants in the control condition took part in elective courses with no intervention instruction. The results of the distal measure of reading comprehension demonstrated no significant differences between groups ($p = .90$; $g = .02$). The authors stated that many of the participants had word level difficulties and

lacked fluency in word reading. They posited that students may not have been able to access the text in the intervention. This could have been considered prior to the intervention by administering measures to ensure that students are able to read the texts.

Multiple Component. Four studies investigated multiple strategies within a single intervention to improve reading comprehension of students with LD (Boardman et al., 2016; Kim et al., 2006; Swanson et al., 2015; Taylor et al., 2002).

Two of the four studies examined the effects of Collaborative Strategic Reading (CSR) on reading comprehension of students with LD (Boardman et al., 2016; Kim et al., 2006). In CSR, participants were taught four strategies: previewing, click and clunk, get the gist, and wrap up. During previewing, participants were instructed to brainstorm and predict prior to reading the text. Within the click and clunk strategy, participants were taught how to use strategies when they encountered words or sentences, they did not understand. During get the gist, participants identified the main idea of the paragraph or the section of the text they read. Finally, during the wrap up strategy, students generated and answered questions and reviewed the main ideas of the passage.

Boardman et al. (2016) examined the effects of CSR on 1,372 students across 60 fourth and fifth grade general education classrooms. Classrooms were randomly assigned to either the treatment or business as usual comparison conditions. The target population for this study was 87 students who were identified as having a learning disability. Results showed that there was no significant main effect of CSR on student outcomes. However, there was a significant interaction effect between condition and posttest scores for participants with LD ($p = .03$; $g = .52$) on a standardized measure of reading. Because the

control condition operated on a business as usual basis, an attentional control would help determine the true effects of CSR.

Kim et al. (2006) examined the effects of a computer-assisted reading comprehension intervention that integrated CSR with 34 students with learning disabilities in sixth, seventh, and eighth grades. Participants in the intervention condition received direct instruction on CSR components while participants in the control condition received instruction to improve fluency and reading comprehension in their resource classroom. Results indicated a statistically significant difference between the two conditions for reading comprehension on researcher-developed proximal measures ($p < .05$; $SMD = .95$) and the distal measure of reading comprehension ($p < .05$; $SMD = .50$). The authors hypothesized that the computer assisted CSR intervention's explicit instruction of modeling, guided practice, and independent practice for reading comprehension strategies and the instructional supports built into the CSR framework (previewing, click and clunk, get the gist, and wrap up) may have been the key elements to seeing the gains in reading comprehension. One limitation of this study is that both teachers who taught the treatment groups also taught the contrast groups which may have introduced a confounding effect in the results.

Swanson et al. (2015) determined the efficacy of a content knowledge and reading comprehension intervention in 72 eighth grade students with disabilities. Participants were randomly assigned to the treatment or a control condition. Participants assigned to the treatment condition took part in Promoting Acceleration of Comprehension and Content Through Text (PACT). In the PACT condition, participants engaged in text

reading, connecting text to prior learning, and applying new knowledge to problem solving activities completed in cooperative groups. Participants assigned to the control condition received regular instruction with no instruction in components included in the treatment condition. Results showed statistically significant differences between groups on content knowledge ($p = .03$; $g = .26$) and content reading comprehension ($p = .01$; $g = .34$), but not for distal measures of reading comprehension ($p = .49$; $g = .09$). The authors conjectured that when students with disabilities received the instructional enhancements offered through PACT including explicit teaching of vocabulary, checks for understanding, and active engagement in content discussions had a direct impact on content knowledge and reading comprehension, but not for the standardized measures.

Text Structure and Summarization. Text structures refer to the way ideas are organized, connections between the ideas, and how vocabulary is used to create meaning to the reader (Jones, et al., 2015; Pyle, et al., 2017). Further, there are six types of text structures: compare and contrast, problem-solution, cause and effect, sequence, enumeration, and description (Pyle, et al., 2017) When students understand the underlying structure of texts, they can focus their attention on relationships and key concepts and monitor their comprehension as they read. Bakken et al. (1997) investigated the effects of a text structure intervention and a summarization intervention on the reading comprehension of 54 students with LD. Students were randomly assigned to one of the three groups: a text structure intervention, summarization intervention or traditional reading instruction. Researchers found statistically significant between group differences ($p < .001$) and large effect sizes when using both a text-structure strategy and

a summarization strategy intervention (Text Structure vs. Control, $d = 3.43$; Summarization vs. Control, $d = 2.14$; Text Structure vs. Summarization, $d = .68$). Both treatment conditions performed better than the control group. However, the text structure condition outperformed the summarization condition when compared.

Summary for Students with LD. In the review of research on reading comprehension strategy instruction, 13 studies examined the effects of different strategies on reading comprehension, including cooperative learning and multiple components. While several studies found statistically significant differences between groups on reading comprehension, Vaughn et al. (2009) and Swanson et al. (2017) found medium to large effect sizes by incorporating vocabulary instruction, building background knowledge, graphic organizers, and paired learning in two separate studies. The combination of strategies had a direct effect on the reading comprehension of both bilingual learners and students with LD. While these studies show promise in improving the reading comprehension of students with LD, there are some limitations that should be noted. First, it is impossible to understand the direct effects of individual strategies packaged within a multiple component intervention. Second, most of these studies took place over an entire school year. The length of treatment in the multiple component interventions spanned several months to an entire school year. We believe that it is important to identify and research individual strategies that improve reading comprehension and can be learned quickly. Consequently, future research should examine the effects of a single strategy to best understand the effects of that component on reading comprehension and how quickly the strategy can be learned. In seven of the

studies with large effect sizes, a common theme was the use of graphic organizers (Swanson, et al, 2015; Vaughn et al., 2009; Vaughn et al., 2017). Given the effectiveness of graphic organizers supporting the reading comprehension of bilingual learners and students with learning disabilities, further research is needed to determine which graphic organizers are most efficacious.

Graphic Organizers and Reading Comprehension

Graphic organizers are visual displays that help students construct meaning through organizing information, clarifying, or simplifying complex information, and establishing relationships across concepts (Boyle, 2000; Kim et al., 2004). These visual displays can be arranged using boxes with arrows, circles or other visual cues to represent conceptual information in an easy to understand format (Ciullo et al., 2015; Stull & Mayer, 2007). Graphic organizers can be used during the reading process to highlight key concepts, assist with note taking (Dexter & Hughes, 2011), and to support students with comprehension of varying text structures, such as descriptive, cause and effect, problem and solution, classification, and compare and contrast. Because of their versatility during the reading process, graphic organizers can be used to help build background knowledge (Dexter & Hughes, 2011) or used during vocabulary instruction (Gallagher et al, 2019). They can also be used to help in making inferences (McCrudden & Rapp, 2017) or taught with different text structures (Strong, 2020).

Graphic Organizers

The use of graphic organizers has proven to be an effective strategy for helping students organize concepts which in turn facilitates reading comprehension. Five studies

examined the effects of graphic organizers on the reading comprehension of students with LD (Boyle, 1996; Boyle 2000; Calvin & Gray, 2020; Ciullo et al., 2015; Dicecco & Gleason, 2002). Boyle (1996) investigated a cognitive mapping strategy on the literal and inferential reading comprehension of 30 middle school students with LD. Participants were matched paired on grade level and pretest scores for silent reading comprehension and then randomly assigned to the treatment or a control condition. Participants in the treatment condition received instruction on how to create a cognitive map while reading. Participants in the control condition received business as usual instruction. Boyle found significant between-group differences ($p = .006$) and large effect sizes for both types of comprehension (Literal $\eta_p^2 = .33$; Inferential $\eta_p^2 = .21$) on proximal measures of reading comprehension. One should cautiously interpret these effects since the treatment group received reading instruction in the general education classroom. An attentional control group may have provided a better estimate of the effects of the intervention.

In a second study, Boyle (2000) also used a between-group design to examine the effects of Venn diagram graphic organizers on the literal, inferential and relational comprehension of 24 ninth and tenth grade students. Participants were randomly assigned to the treatment or control group. Participants in the graphic organizer group were taught how to use a Venn Diagram and use a mnemonic device while reading compare and contrast texts, while participants in the control group received business as usual instruction. Boyle found significant between group differences ($p < .05$) and large effect sizes for literal ($d = 1.17$) and relational ($d = .87$) comprehension, but no significant differences for inferential ($p > .05$; $d = .36$) comprehension on proximal measures. Boyle

stated that the Venn diagram allowed students to organize information from passages that helped improve their literal and relational knowledge about the topics. However, the authors did not state which element of the intervention was most effective, the Venn diagram or the mnemonic device. Thus, it is difficult to parse out the active ingredient within the intervention.

DiCecco and Gleason (2002) examined the effects of graphic organizers on reading comprehension of 24 sixth through eighth grade students with LD. Participants in the graphic organizer condition used graphic organizers to connect the main idea of a text to supporting details and establish relationships among concepts. Participants in the control condition received the same instruction as the treatment group with the exception of no instruction in the use of graphic organizers. The results of the study found no statistically significant differences between groups on content knowledge ($p = .2641$) or factual ($p = .8461$) reading comprehension measures. The authors posited that graphic organizers are not meant to help students recall factual information or make inferences, but more to establish relationships among concepts.

Two additional studies used single case design to investigate the effects of graphic organizers on the reading comprehension of upper elementary and middle school bilingual learners and students with LD (Calvin & Gray, 2020; Ciullo, et al., 2015). Calvin and Gray (2020) provided explicit instruction on the use of a graphic organizer of 7th and 8th grade Spanish-English bilingual students ($n = 3$) reading compare and contrast expository texts. The intervention took place over twelve one-hour sessions and was taught by trained undergraduate research assistants. Students learned to create a double-

bubble map, a type of Venn diagram, while reading compare and contrast texts. After completing the double-bubble map, students answered comprehension questions related to the text using the graphic organizer. Across baseline and intervention phases, results suggested a large effect size ($p < .05$; $Tau-U = .94$) on proximal measures of reading comprehension.

Ciullo et al. (2015) examined the use of a graphic organizer on the social studies reading comprehension of fourth and fifth grade students with learning disabilities ($n = 7$) for 45 minute sessions over a six-week period. A certified teacher delivered the intervention for all students. Students received a pre-made graphic organizer with information pre-filled from the text. Every three sessions, two boxes were left blank for students to complete with the teacher's assistance. After completing the graphic organizer, students reviewed the information with the teacher and then answered comprehension questions related to the passage. The researchers found a large effect size ($PND = .96$) across baseline and intervention phases.

Rationale

When students enter intermediate and middle grades, the use of comprehension strategies can contribute to improved comprehension of written texts (Edmonds, et al., 2009). Previous research has shown that many bilingual learners and students with LD benefit from strategy instruction to understand what they are reading. Studies that proved to have the largest effects on reading comprehension for bilingual learners and students with LD were involved multiple components (Vaughn et al., 2009; Vaughn et al., 2011) and included the use of graphic organizers (Boyle, 1995; Boyle, 2000; Calvin & Gray,

2020; Ciullo et al., 2015). While these studies have proven to be efficacious, there are limitations. First, since most of the reviewed studies used multiple components, we do not know what the active ingredient was that resulted in significant between group differences. It is important to parse out these strategies to better understand which components best improve reading comprehension of bilingual learners with LD. Second, the length of treatment in the multiple component interventions spanned several months to an entire school year. Third, it is important to identify strategies that improve reading comprehension that can be learned quickly. Finally, several of the multiple component interventions used classroom teachers as the interventionist which may become cost prohibitive for schools. However, interventions that can be delivered by trained classified personnel may be more feasible and cost effective to deliver.

Purpose

Given the effectiveness of using graphic organizers in single-case design studies (Calvin & Gray, 2020; Ciullo et al., 2015) and in multiple component interventions (Boyle, 1996, 2000; Swanson, et al., 2015; Vaughn et al., 2009; Vaughn et al., 2017) with bilingual learners and students with LD, the purpose of this study was to evaluate of one type of graphic organizer (funnel map) to determine if it improves the reading comprehension of bilingual learners with LD when they are reading descriptive expository texts.. The study addressed some of the limitations noted above. We investigated a single strategy that was delivered by trained research assistants over ten one-hour sessions. The intervention lessons were directly aligned with CCSS literacy strands within content area standards. The intervention utilized explicit instruction to

teach students to use a graphic organizer as a notetaking tool to aid in the comprehension of descriptive texts.

We hypothesized that the use of the funnel map would enable students to better comprehend expository texts because of its ability to help readers focus on key concepts and how they relate to other concepts in the text, thus reducing the need to hold information in working memory. The research questions were:

1. Are students able to independently draw and correctly label a funnel map within 10 sessions?
2. Does explicit instruction on the use of the funnel map increase reading comprehension in students who are bilingual learners with low comprehension?
3. Did explicit instruction appear to have a bigger effect on literal or inferential questions?
4. Do students perceive the usefulness of the funnel map in help with reading comprehension

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Improving Expository Text Comprehension in Adolescent Spanish-English Bilingual Learners using a Graphic Organizer

The reading proficiency of Spanish-English bilingual learners with learning disabilities (LD) is of high concern for both educators and researchers. According to the National Assessment for Education Progress (NAEP; National Center for Education Statistics (NCES), 2019a), 96 percent of bilingual learners and 91 percent of students with disabilities in eighth grade were reading below proficient levels on national assessments of reading. On the 2019 NAEP reading assessment, bilingual learners scored 221 and students with disabilities scored 229, with 280 considered ‘proficient.’ While NAEP did not report the number of Spanish-English bilingual learners with LD reading at proficiency, they did report that 78 percent of Hispanic students were reading below proficient levels compared to 58 percent of their White peers.

The population of bilingual learners in the United States has increased over the last two decades. Since 2000, the percentage of Spanish-English bilingual students increased from 16 percent to 25 percent (NCES, 2019b). In 2015, 4.9 million children whose heritage language was one other than English attended public schools in the United States and of that number, 77 percent spoke Spanish as their heritage language (NCES, 2019a). In the 2018-19 school year, the number of Spanish-English bilingual learners in public schools who received special education services approached one million (NCES, February 2020; NCES, May 2020). Of these children, over 740,000 were identified as having a specific learning disability. Because of the increasing population of bilingual learners, our attention must focus on how to provide them with the tools and

supports to comprehend written texts. Reading comprehension is arguably the most important skill for children to develop as they progress through their formal education.

However, many adolescent bilingual students with LD struggle with reading comprehension in the late elementary and middle grades as they encounter different text structures (Lesaux & Kieffer, 2010, Li, et al. 2020) and the demand for more complex oral language skills, vocabulary, and background knowledge increases (Farnia & Geva, 2013). Moreover, adolescent bilingual learners with LD often lag behind in the development of these complex skills in English (Grimm et al., 2018; Kieffer, 2012; Lesaux & Kieffer, 2010). Because many adolescent bilingual learners with LD have poor reading comprehension, they are at risk for academic failure (Fagella-Luby & Deshler, 2008; Richman et al., 1998) and at risk for dropping out of school (Vaughn et al. 2015).

This study focused on a reading comprehension intervention using expository texts for Spanish-English bilingual students with LD at the middle school level. Expository texts become increasingly important in elementary school as students begin to rely more on reading for learning. Moreover, expository texts are more difficult to comprehend than narrative texts because they contain new and abstract concepts and discuss complex relationships among concepts (Coté et al., 1998; Kraal et al., 2018; Meyer & Ray, 2011). As students enter the middle grades, content area educators expect students to be able to understand complex grade level expository texts. However, many bilingual students with LD struggle with reading comprehension of expository texts (Lesaux et al., 2010; Mancilla-Martinez & Lesaux, 2010; Swanson et al., 2017).

Although there is a great need for research-based reading comprehension interventions for bilingual students with LD, there are few studies with this population of students. Our goal was to address the need for research in this area by examining the effects of reading comprehension interventions designed specifically for students who are bilingual learners and students with learning disabilities in fourth through ninth grades. We identified several studies that were associated with improved outcomes for bilingual learners and students with disabilities. Many of the studies used multiple components within an intervention for improving reading comprehension. However, a common tool that was used in these “packaged” interventions was the use of graphic organizers. Realizing that graphic organizers may be a tool that was effective in supporting the reading comprehension of our population of students, we then focused our attention on studies that isolated the use of graphic organizers.

Multiple Component Interventions with Graphic Organizers

Interventions with multiple components can be operationally defined as interventions that integrate several reading comprehension strategies into a single intervention (Vaughn & Edmonds, 2006). These may include cooperative learning, main idea instruction, explicit vocabulary instruction, building background knowledge, summarization, teaching text structures, questioning techniques, and graphic organizers (National Reading Panel, 2000). Moreover, interventions that include text previews, vocabulary instruction and building background knowledge, using graphic organizers, and questioning strategies have shown to facilitate recall and comprehension of text (Rapp et al., 2007).

The effect of multiple component interventions has been investigated with Spanish-English bilingual learners. Vaughn et al. (2009) intervened on social studies vocabulary and reading comprehension for seventh grade Spanish-English bilingual students in two studies using vocabulary instruction, videos to build background knowledge, graphic organizers, and paired learning. In Study 1, 381 participants were randomly assigned to one of 15 sections of social studies and the sections were randomly assigned to teachers. In Study 2, 507 participants were randomly assigned to one of 17 sections of social studies and the sections were randomly assigned to teachers. In both studies, the treatment group received an overview of the lesson and vocabulary instruction, watched videos, and participated in discussion to build concept knowledge, used graphic organizers to build comprehension and vocabulary, and participated in structured paired grouping. Students received instruction 50 minutes a day, 5 days a week, for 9 to 12 weeks. Participants in the treatment groups outperformed the control group with both studies yielding statistically significant differences between the treatment and control groups for vocabulary (Study 1: $p = .002$; $g = .53$; Study 2: $p = .016$; $g = .45$) and reading comprehension (Study 1: $p < .001$; $g = 1.12$; Study 2: $p = .016$; $g = .99$) on researcher created content-based vocabulary reading comprehension measures.

Multiple component interventions have also been used to support the reading comprehension of struggling readers, including students with learning disabilities. Three studies used a yearlong treatment to intervene on the reading skills of sixth through eighth grade students who scored below proficient on state reading assessments (Vaughn et al., 2010, $n = 356$; Vaughn et al., 2011, $n = 182$) and students with learning disabilities

(Wanzek et al., 2011, $n = 135$). Students were randomly assigned to a control or treatment condition. Students in the control condition received instruction in the general education classroom that focused on identifying and asking questions, using a note-taking guide using main idea and summarizing strategies, identifying text structures, and using graphic organizers. The intervention was completed in small groups of 10-15 students across three phases. Phase 1 consisted of 25 lessons over a seven to eight week period that focused on word studies, fluency instruction, and vocabulary and reading comprehension instruction. During Phase 2 (17-18 weeks), teachers focused on building vocabulary related to the text and building reading comprehension by having students complete a graphic organizer that summarized key information from the text. Students also engaged in repeated readings to increase fluency, answered questions about the text, and wrote summaries. In Phase 3 (8-10 weeks), students focused on applying the skills and strategies learned in the previous phases and learned comprehension and critical thinking skills. Results varied across the three studies. Vaughn et al. (2010) found nonsignificant results on state testing with a small effect ($p = .167$, $d = .18$) while Vaughn et al. (2011) found significant results with a medium effect ($p < .001$, $ES = .56$) for reading comprehension in struggling readers. Wanzek et al. (2011) found nonsignificant results with a small effect ($p > .05$, $\eta^2 = .017$) for students with learning disabilities.

Vaughn et al. (2009, 2011) found medium to large effect sizes by incorporating vocabulary instruction, building background knowledge, graphic organizers, and cooperative learning strategies. The combination of strategies had a positive effect on the reading comprehension of both bilingual learners and struggling readers. However, it is

not possible to understand the direct effects of individual strategies packaged in a multiple component intervention. In each of the reviewed studies, graphic organizers were one of several tools used to improve reading comprehension in bilingual learners, students with learning disabilities and struggling readers. Given the fact that graphic organizers have been used in multiple component interventions, we wanted to better understand the role graphic organizers play in reading comprehension.

Graphic Organizers and Reading Comprehension

Graphic organizers are visual displays that help students construct meaning by organizing information, clarifying or simplifying complex information, and establishing relationships across concepts (Boyle, 2000; Kim et al., 2004). These visual displays can be arranged using boxes with arrows, circles or other visual cues to represent conceptual information in an easy to understand format (Ciullo et al., 2015; Stull & Mayer, 2007). Graphic organizers can be used during the reading process to highlight key concepts, assist with note taking (Dexter & Hughes, 2011), and to support students with comprehension of varying text structures, such as descriptive, cause and effect, problem and solution, classification, and compare and contrast. Because of their versatility during the reading process, graphic organizers can be used to help build background knowledge (Dexter & Hughes, 2011) or used during vocabulary instruction (Gallagher et al, 2019). They can also be used to help in making inferences (McCrudden & Rapp, 2017) or taught with different text structures (Strong, 2020).

Additionally, as students read texts, they rely on their attention and working memory to process what they are reading. Attention involves a student's ability to focus

on a message and that message is stored in working memory (McCrudden & Rapp, 2017). Working memory provides the temporary storage of information necessary to perform complex tasks such as comprehension, learning and reasoning (Baddeley, 2010). When used during reading, a graphic organizer may improve a student's processing efficiency by providing a permanent representation of the mental model of text, by helping to organize important information, and by highlighting connections among concepts in the text (McCrudden & Rapp, 2017). Moreover, a graphic organizer can reduce the need to hold information in working memory while reading and reducing the need to search for important information in the text.

Graphic Organizers Interventions

The use of graphic organizers has proven to be an effective strategy for helping students organize concepts which, in turn, facilitates reading comprehension. According to prior meta-analyses, students with learning disabilities benefited from the use of graphic organizers, as their reading comprehension improved in both factual recall (Kim et al, 2004) as well as inferencing (Dexter & Hughes, 2011). The hypothesis for this effect is that graphic organizers help students to organize written information, thereby improving students' recall (Kim, et al., 2004). In a more recent meta-analysis on the effects of instructional strategies on the reading comprehension of English Learners, Li et al. (2021) found that graphic organizers provide bilingual learners with a “visual representation which helps them tangibly and systematically understand text concepts and link fragments of information together” (p. 13). Further, Li et al. (2021) found a large

effect for bilingual learners' reading comprehension and the use of graphic organizers ($g = .98$)

Several studies have examined the effects of graphic organizers on the reading comprehension of students with LD. Boyle (1996) found significant between-group differences in favor of the treatment group ($p = .006$) and large effect sizes for both literal and inferential comprehension (Literal $\eta_p^2 = .33$; Inferential $\eta_p^2 = .21$) on proximal measures of reading comprehension when using a cognitive mapping strategy, a type of graphic organizer, on 30 middle school students with LD. Boyle (2000) also found significant between group differences ($p < .05$) and large effect sizes for literal ($d = 1.17$) and relational ($d = .87$) comprehension in favor of the treatment group, but no significant differences for inferential comprehension ($p > .05$; $d = .36$) on proximal measures using a Venn diagram while reading compare and contrast texts with 24 9th and 10th grade students.

Two additional studies used single case design to investigate the effects of graphic organizers on the reading comprehension of upper elementary and middle school bilingual learners and students with LD (Calvin & Gray, 2020; Ciullo, et al., 2015). Calvin and Gray (2020) provided explicit instruction on the use of a graphic organizer of 7th and 8th grade Spanish-English bilingual students ($n = 3$) reading compare and contrast expository texts. The intervention took place over twelve one-hour sessions and was taught by trained undergraduate research assistants. Students learned to create a double-bubble map, a type of Venn diagram, while reading compare and contrast texts. After completing the double-bubble map, students answered comprehension questions related

to the text using the graphic organizer. Across baseline and intervention phases, results suggested a large effect size ($p < .05$; $Tau-U = .94$) on proximal measures of reading comprehension. Ciullo et al. (2015) examined the use of a graphic organizer on the social studies reading comprehension of fourth and fifth grade students with learning disabilities ($n = 7$) for 45 minute sessions over a six-week period. A certified teacher delivered the intervention for all students. Students received a pre-made graphic organizer with information pre-filled from the text. Every three sessions, two boxes were left blank for students to complete with the teacher's assistance. After completing the graphic organizer, students reviewed the information with the teacher and then answered comprehension questions related to the passage. The researchers found a large effect size ($PND = .96$) across baseline and intervention phases.

Summary

When students enter intermediate and middle grades, the use of comprehension strategies can contribute to improved comprehension of written texts (Edmonds, et al., 2009). Previous research has shown that many bilingual learners and students with LD benefit from strategy instruction to understand what they are reading. Studies that proved to have the largest effects on reading comprehension for bilingual learners and students with LD were involved multiple components (Vaughn et al., 2009; Vaughn et al., 2011) and included the use of graphic organizers (Boyle, 1996; Boyle, 2000; Calvin & Gray, 2020; Ciullo et al., 2015). While these studies have proven to be efficacious, there are limitations. First, because most of the reviewed studies used multiple components, we do not know what the active ingredients were that resulted in significant between group

differences. It is important to parse out these strategies to better understand which components best improve reading comprehension of bilingual learners with LD. Second, the length of treatment in the multiple component interventions spanned several months to an entire school year. It is important to identify strategies that improve reading comprehension that can be learned quickly. Finally, several of the multiple component interventions used classroom teachers as the interventionist which may become cost prohibitive for schools. However, interventions that can be delivered by trained classified personnel may be more feasible and cost effective to deliver.

Purpose

Given the effectiveness of using graphic organizers in single-case design studies (Calvin & Gray, 2020; Ciullo et al., 2015), group studies (Boyle, 1996; Boyle, 2000), and in multiple component interventions (Vaughn et al., 2009; Vaughn et al., 2011) with bilingual learners and students with LD, the purpose of this study was to evaluate of one type of graphic organizer (funnel map) to determine if it improves the reading comprehension of bilingual learners with LD when they are reading descriptive expository texts.. The study addressed some of the limitations noted above. We investigated a single strategy that was delivered by trained research assistants over ten one-hour sessions. The intervention lessons were directly aligned with Common Core State Standards (CCSS; National Governors Association, 2010) literacy strands within content area standards. The intervention utilized explicit instruction to teach students to use a graphic organizer as a notetaking tool to aid in the comprehension of descriptive texts.

We hypothesized that the use of the funnel map would enable students to better comprehend expository texts because of its ability to help readers focus on key concepts and how they relate to other concepts in the text, thus reducing the need to hold information in working memory. The research questions were:

1. Are students able to independently draw and correctly label a funnel map within 10 sessions?
2. Does explicit instruction on the use of the funnel map increase reading comprehension in students who are bilingual learners with low comprehension?
3. Did explicit instruction appear to have a bigger effect on literal or inferential questions?
4. Do students perceive the usefulness of the funnel map in help with reading comprehension

Method

We used a single case, multiple baseline across students design in this investigation. We followed the What Works Clearinghouse Handbook 4.1 Single Case Design guidelines (2020) to ensure that the study met standards without reservations. The study consisted of three phases: baseline, intervention, and maintenance and had five baseline data points, 10 intervention data points, and two maintenance data points with three replications. The study took place via Zoom, an online platform, which allowed students to participate in the intervention without in-person contact due to COVID-19 restrictions. All baseline, intervention, and follow up sessions were delivered in a 1:1 format with a research assistant (RA) and a student via Zoom.

Participants

Seventh and eighth grade students were recruited from 10 school districts across the state of Arizona and through Facebook advertisements. Flyers for the study were given to district and building administrators to distribute to the families of potential students. Consent packets and questionnaires were provided to families in both Spanish and English. Parents completed a questionnaire to provide demographic information about their family and child including race, ethnicity, and languages spoken in the home (see Table 1). We received two student consents through district recruitment. However, because of low enrollment numbers, we also posted a Facebook advertisement to recruit students. We received seven consents through the Facebook ad. Study procedures were reviewed and approved by the Arizona State University Institutional Review Board to ensure that the study aligned with ethical principles and complied with federal requirements for protecting the rights of human subjects during research (see Appendix C).

To qualify for inclusion in the study students met the following criteria: (a) enrolled in seventh or eighth grade (b) started preschool or kindergarten speaking primarily Spanish per parent report; (c) achieved a standard score of 75 or higher on the nonverbal subtest of the Kaufmann Brief Intelligence Test Second Edition (KBIT-2, Kaufman & Kaufman, 2004); (d) standard score below 85 on the Woodcock Reading Mastery Test (WRMT) Passage Comprehension subtest (Woodcock, 2011); and (e) scaled score of 75 or above on the decoding subtest of the Test of Word Reading Efficiency-2 (TOWRE 2, Wagner, Torgesen, & Rashotte, 2011). Nine students consented

for the study. Of the nine students consented, two students never responded to scheduling requests and three students were excluded because of high scores in baseline testing. Of the four who started the study, one did not complete the sessions due to scheduling conflicts. Thus, three students completed the study. See Table 2 for descriptive statistics.

Materials

Expository Texts

Prior to the start of the study, twenty-five ethnic biographical reading passages were written at a 6th grade level by the first author. This level was selected because students who are low comprehenders typically read and comprehend text below grade level; therefore, we did not want them to become discouraged if they could not read or understand the texts. To further mitigate word reading difficulties, each research assistant read the same randomly assigned text during each baseline and intervention session while the student followed along (See Appendix D for Sample Passage). The researcher-created texts were equated using Coh-Metrix metrics (Graesser et al., 2011). Each passage was written to score within one standard deviation of the word length ($M = 256$; $SD = .53$), sentence length ($M = 12.74$; $SD = .01$), and grade level ($M = 6.5$; $SD = .06$) mean for baseline passages (see Table 3) and intervention passages (see Table 4).

Funnel Map

We taught students to create a funnel map to record handwritten notes about the details and to infer the main idea in each expository text (see Figure 1 for an example). Students created the funnel map as the RA read the passage to them. Each paragraph of the text had a vertical flow where students listed key details of each paragraph. After

identifying the key details in each paragraph, students reviewed the information and determined the main idea of the passage. The design of the map allowed students to see how details contribute to the main idea of the text and to record the key details without having to read back through the text to find information. Note that in Figure 1, although three paragraphs are represented in the funnel map, some texts may have more or fewer than three paragraphs and some paragraphs have more or fewer details to provide varied practice. The funnel map has the flexibility to be adapted to varying lengths of texts.

Measures

Inclusionary Measures

KBIT-2. The KBIT-2 was used as a screening measure to ensure that students' nonverbal IQ was 75 or higher. The matrices subtest consists of 46 nonverbal measures composed of different types of items involving visual stimuli. The reliability for the KBIT-2 Matrices subtest is .88 and had correlational scores to the WISC-III and WISC-IV of .53 and .56.

TOWRE-2. The TOWRE-2 was administered to ensure that students were able to decode the reading passages written at a sixth-grade level. Students completed the Sight Word Efficiency (SWE) and the Phonemic Decoding Efficiency (PDE) subtests which are timed tests. The TOWRE is a nationally normed measure with reliability above .90. The test-retest coefficients range from .83 to .96.

WRMT. The passage comprehension subtest of the WRMT was administered to better understand students' ability to comprehend written text. The passage comprehension subtest uses a cloze procedure where a word(s) is omitted from a

sentence. The student supplied a word that was appropriate for the sentence. Reliability for each of the clusters exceeded .80. Concurrent validity with the Woodcock-Johnson III passage comprehension was high (.68).

Baseline and Intervention Measures

Baseline and intervention measures assessed the student's ability to correctly draw and label the graphic organizer funnel map (our criterion variable) and to answer 10 comprehension questions (see description below) about the researcher-created expository texts. During the intervention phase, the assessment was administered after the end of the teaching session. During the assessment, the RA read the passage aloud to the student to ensure that reading decoding problems did not negatively impact the student's understanding of the text. The RA then reread the passage and prompted the student to create a funnel map that included key details from each paragraph and the identification of the main idea. Then, the student answered 10 comprehension questions related to the text.

Funnel Map Measure. The funnel map served as the criterion variable. The student received one point for each key detail listed. The total number of key details listed by the student were divided by the total number of correct details in the text to determine the percentage correct. For example, if a student listed seven details in the biographical text, but there were 10 details in the passage, the student received a score of 70 percent.

The student also received three points for correctly identifying the main idea. More points were awarded for the main idea because inferring the main idea requires a

synthesis of key details, rather than identifying information explicitly stated in the text. The main idea was scored by trained research assistant using a rubric (see Appendix E). Students earned three points if their response clearly synthesized information across the passage to form the main idea, two points if their response synthesized one or two details in the passage, one point if they retold the information in the passage with no synthesizing, and zero points if they only stated the topic of the passage.

To calculate an overall score for the funnel map, the percentages of the key details and main idea were added together and divided by two to determine the overall percentage. For example, in the previous example, if a student received 70 percent on key details and 100 percent on the main idea, the sum of the two scores is 170. This score would be divided by two for a total score of 85 percent on the funnel map. We chose to weigh the key details and main idea with a weighting of 50/50 because the synthesizing information to identify the main idea is a higher-level skill.

Reading Comprehension Measures. For baseline and intervention phases, the reading comprehension measures used the same type of text passages used during the intervention phase (see description under materials). Each researcher-created multiple-choice measure had 10 items consisting of six factual comprehension questions and four inferential comprehension questions (See Appendix F). For the factual comprehension questions, the student was asked to recall information explicitly stated in the text. For inferential comprehension questions, the student inferred the answer.

Inter-Rater Agreement for Baseline and Intervention Measures

The funnel map and reading comprehension measures were initially scored by the interventionist RA and then double scored by the first author. All assessments in each phase of the study were double scored to calculate inter-rater reliability. Any disagreements were resolved by consensus. The percentage of agreement were calculated by dividing the number of agreements by the number of agreements plus the number of disagreements and multiplying by 100. One hundred percent of assessments in each phase of the study were double scored by a researcher assistant to calculate inter-rater agreement. A score of 92% was attained for funnel map measures and 100% for reading comprehension measures.

Descriptive Measures

Social Validity Measure. Students completed a post-intervention survey to assess their beliefs about the efficacy of the intervention (see Appendix G). The four multiple-choice questions asked whether students felt the use of the graphic organizer funnel map helped them in their understanding of biographical texts and whether they would use the funnel map in the future. Students chose one of four responses, “Strongly Disagree; Disagree, Agree, or Strongly Agree” with strongly disagree being scored as one point and strongly agree being scored as four points. Two additional open response questions asked for specific feedback on what they liked and disliked about the graphic organizer intervention.

Procedures

Research Assistants

The research assistants were undergraduate and graduate students. The first author provided explicit intervention delivery training to 14 research assistants (RAs) in a group format prior to study initiation. The training consisted of how to administer measures and deliver the interventions from start to finish with fidelity through Zoom. Before the RAs could work with students, they were required to teach two intervention lessons to the first author. A fidelity checklist (see Appendix H) was used to determine if each assistant delivered the lessons as planned with 100% fidelity. All research assistants met the training criteria to deliver the intervention with 100% fidelity on two separate checks.

Randomization of Texts

Prior to beginning the study, from a pool of 23 biographical texts, we randomly assigned a text and its corresponding reading comprehension questions to one of the baseline sessions, intervention sessions, data point assessments, or maintenance sessions. The order texts were the same across students.

Baseline Phase

All seven students entered the baseline phase simultaneously. Baseline data were collected on multiple consecutive days to determine which students had a stable baseline. During the baseline phase, the RA read the randomly assigned descriptive text to the student and instructed them to use a blank piece of paper to create a graphic organizer as a notetaking tool during a second reading of the text. The creation of the graphic organizer served as the funnel map measure, our criterion variable. At the end of the reading, the RA administered the reading comprehension measure (see description below).

After five baseline data points, three of the seven students scored between 90% and 100% on the reading comprehension measures. Thus, they were not included in the study. Therefore, four students continued in the baseline phase of the study. Of the four students left in baseline, one dropped out of the study because of scheduling conflicts. Of the three students, one was male and two were female (See Table 2).

From all students with a stable baseline trend on the funnel map measure over five data points, one was randomly selected to enter the intervention phase first. WWC requires at least five stable baseline data points prior to students moving into the intervention phase to meet standards without reservation. Baseline stability was determined by an outside person who was not informed of the study's purpose and who could evaluate the data without bias. Baseline data were collected on the remaining students three days (three data points) just prior to the time the next randomly selected student was to enter intervention, at which time a series of three baseline measures over three days were administered to determine stability.

We measured students' performance on the creation of the funnel map because this graphic organizer formed the basis of our treatment approach. Thus, we tracked how quickly students learned to create the map in response to reading a biographical text. When the first student in the intervention phase demonstrated a positive-growth trend on at least three funnel map measures between baseline and intervention, an experimental effect was considered established (Cuillo, Falcomata & Vaughn, 2017) and the next randomly selected student entered intervention. We followed the same procedure for the entrance of subsequent students until student had entered the intervention phase. At the

end of each session, the RA administered a funnel map and a reading comprehension measure (see description above).

Intervention Phase

During the intervention phase, each student worked with a trained RA for two one-hour sessions per week over the course of five weeks. Each RA taught the same student throughout the intervention phase. The RA delivered scripted lessons using a direct instruction teaching method (Archer & Hughes, 2011). See Appendix I for a sample lesson plan. Instruction was focused on the development of the funnel map, identifying the main idea, and supporting details of a text, and practice answering comprehension questions. The RA and student spent five minutes setting the stage for the lesson, 15 minutes each for I Do, We Do, You Do sections of the lesson (described below), and five minutes for closure.

During each intervention session, the RA read a biographical text while the student followed along (see description under materials) and the student created a funnel map with key details and the main idea on a piece of paper (see description under materials). After listing the key details of a paragraph, the student held their funnel map up to the camera for the RA to review and provide feedback. Students used the funnel map to help them answer 10 comprehension questions (six literal, four inferential) about each text. During each lesson, the RAs followed a scripted regimen of activities that includes Setting the Stage, I do, We do, You Do, and Closure components. During Setting the Stage, the RAs reviewed the previous lesson, explained what the students would be doing during that session and briefly reviewed pertinent vocabulary that

perained to the text of the day. As the lesson transitioned to the I do, or modeling stage, RAs modeled reading the text, creating a funnel map, added key details from the text to the map, synthesized across the key details to determine the main idea, and practiced answering comprehension questions using the information in the funnel map. When students enter the We Do, or guided practice phase, the RAs continued to lead the lesson, checked for understanding, provided feedback, and helped students practice the new skills with support. During the You Do, or independent practice stage, the students practiced creating a funnel map with the same passage by listing key details, synthesizing the main idea and answering reading comprehension questions with the aid of the funnel map, while the RA monitored their work. During Closure, the RAs or students synthesized what they learned that session.

Lessons 1 and 2 were written to be introductory lessons where students were explicitly taught how to create and use a funnel map when reading an informational text. In these lessons, the RAs modeled how to identify important details of each paragraph of the descriptive text and how to use the funnel map to identify the main idea. Lessons 3 through 7 had a strong emphasis on the We Do component of the lesson. During these lessons, the RAs gave the students more opportunities to practice the skills they learned while providing explicit feedback and support. While all components of the lessons were delivered each session, lessons 8 through 10 emphasized the You Do component, ultimately relinquishing control of learning to the student. This allowed students to practice creating the funnel map independently. If students were unable to independently

draw the funnel map, the RA offered support to ensure that learning continued to take place.

Treatment Fidelity. To assess treatment fidelity of the intervention, a trained RA attended and observed each session for 100% of the lessons. The RA used a rubric to determine whether each of the planned instructional steps were observed (see Appendix H). The fidelity rubric was based on a four-point scale. The interventionist RA could earn one to four points for delivering the lesson exactly as it was scripted for each section of the lesson plan (Setting the Stage, I Do, We Do, You Do, and Closure). Thus, a total of 20 points could be earned. The percentage of treatment fidelity was calculated by adding the total number of earned points and then dividing it by 20. A fidelity implementation score of 98.6% was attained (range = 96% - 100%) throughout the intervention phase. After each lesson was observed, the fidelity checker submitted the rubric to the first author. After reviewing the rubric, the first author coached the RA in area(s) of need. We believe that we achieved a high level of fidelity because each of the lessons were scripted.

Maintenance Phase

Two assessment sessions were conducted during the maintenance phase; the first approximately one week after the intervention ended and the second about four weeks after the intervention had ended. During these sessions, the RA administered both a funnel map measure and a reading comprehension measure.

Analytic Approach

Each student's data was evaluated using a visual analysis to compare the effects of the independent treatment variable on the outcome variables. In other words, we wanted to determine if students were able to independently draw and correctly label a funnel map within 10 treatment sessions and if the use of the funnel map had an effect on reading comprehension. Both the TAU-U (Parker et al, 2011) and the Between Case-Standardized Mean Difference (BC-SMD; Valentine et al., 2016) were used to calculate an effect size for each dependent variable.

Visual Analysis

To determine if students were able to correctly draw and label a funnel map within 10 sessions and if the use of the funnel map had an effect on reading comprehension, we examined within-phase and between-phase data for each dependent variable. The visual analyses were based on the observed data within the baseline, intervention and follow up phases. The observed data within each phase was evaluated based on the features of (a) level (mean); (b) trend (best-fitting line slope); (c) variability (variation of data from the mean); (d) immediacy of effect (the change in the last three baseline data points and the first three intervention data points); (e) overlap (proportion of overlapping data points between baseline and intervention); and (f) consistency of data in similar phases (consistency of data from all phases with the same conditions). Data patterns across phases were investigated for (a) the visible distinction between the data features of the baseline data points and the intervention data points and (b) the percentage of data points overlapping between the baseline phase and the intervention phase with

low overlapping suggesting larger treatment effect sizes (Horner, et al, 2012; Lenze, 2013; WWC, 2010).

TAU-U

The TAU-U analysis, a nonoverlap index of effect, was used to examine group treatment effects between the baseline phase and the intervention phase. TAU-U is well suited for the small datasets in single case design and provides *p*-values for statistical significance (Parker, Vannest, Davis & Sauber, 2011). The individual TAU contrast was calculated for the funnel map criterion variable and the reading comprehension, the dependent variable, for each student. In addition, a weighted TAU-U contrast was calculated for an overall treatment effect. The weighted TAU-U is a calculation of each student's phase contrasts between baseline and treatment for the dependent variable and intervention combined to give an overall intervention effect. TAU-U effect scores range from 0 to 1 with weak to small effect sizes specified by .65 or less, medium to high effect sizes specified by .66 to .92 and large or strong effect sizes specified by .93 or greater (Rakap, 2015).

Between Case-Standardized Mean Difference

The Between Case-Standardized Mean Difference (BC-SMD) was used to calculate an across-student effect size that measured the effectiveness of the intervention. BC-SMD estimates the same effect size as in between-case experimental designs, using data from a single case design (Hedges, Pustejovsky, & Shadish, 2012, 2013; Pustejovsky, Hedges, & Shadish, 2014; Shadish, Hedges, & Pustejovsky, 2014). B-SMD was chosen because it offers an effect size that is comparable to group design studies and

can be interpreted like Cohen's d for single case design studies (Ruiz, et al. 2018). We used a web-based calculator to generate the BC-SMD for single case design research that includes a correction for small sample sizes, uses the restricted maximum likelihood estimator, and provides an effect size, standard error, confidence intervals, and auto-correlations (Pustejovsky, Chen, & Hamilton, 2021). For the dependent variable (reading comprehension), we used a model that included a stable baseline trend and a change in level for the intervention phase.

Results

A summary of observed means, range, individual TAU-U, and BC-SMD is presented in Table 1. Individual baseline and intervention graphs are presented in Figure 2 and visual analyses graphs are presented in Figure 3.

Funnel Map Results

Performance on the funnel map task was the criterion variable for entry into the intervention phase of the study. All students presented a stable baseline for the criterion variable. Since all students had a stable baseline across five data points, one student was randomly selected to enter the intervention phase. Meanwhile, the other students remained in baseline until the first participant demonstrated three upward trending data points for creating and labeling the funnel map.

Data points were collected on the funnel map during the intervention phase beginning in the first treatment session. All participants demonstrated an understanding of the concept of the funnel map by listing key details for each paragraph and attempting to identify the main idea after one session. While Participant 2 demonstrated the ability to

accurately create a funnel map with key details and the main idea with 90% accuracy after one session, Participant 1 showed steady growth over four data points in creating a funnel map to 90% accuracy and Participant 3 struggled with the mastery of the funnel map. While participant 3 demonstrated the ability to identify most of the key details in each paragraph, the synthesizing of the key details to identify the main idea never fully materialized. However, when comparing the effects from baseline to intervention, the positive response of data patterns and replications across participants, indicated a positive experimental effect, which is supported by TAU-U and BC-SMD ($TAU-U = 1.0$; $p < .01$; $BC-SMD = 1.71$). See Table 5 for baseline and reading comprehension funnel map measures and individual effect sizes. See Figure 4 for visual analysis of main idea and key details.

Maintenance-phase data points were collected two weeks and four weeks post intervention. Participant 1 scored 97.5% and 86% on the funnel map measure for first and second post intervention data points respectively, while participant 2 scored above 90% on the funnel map during the two and four week maintenance check. Participant 3 scored 62% and 63% on the funnel map measure for first and second post intervention data points.

Reading Comprehension Results

The baseline, intervention, and maintenance phases for reading comprehension are shown in Figure 2. Recall that the order of reading passages was randomized across participants so that every participant was reading the same passage at each time point. Each reading comprehension measure contained ten questions (six literal and four

inferential) and participants earned between zero and 100% based on the number of questions answered correctly. During baseline, students demonstrated variability on the reading comprehension measures. Participant 1 and 3 showed the least variability and ranged from scoring 40% to 80%, while Participant 2 showed greatest variability and ranged from 40% to 90%. While the reading passages were leveled and the complexity was standardized, we have not tested the relative equivalence of the measures in a large group of students.

Reading comprehension measures were administered at the end of each of the ten intervention sessions. All students showed a positive response to the intervention based on these measures. After two sessions, Participant 1 showed an increase in reading comprehension with scores of 90% or 100% for sessions three through ten and an individual *TAU* effect size of .92 ($p < .001$). Participant 2 consistently scored between 90% and 100% on the reading comprehension measures until the last session with an individual *TAU* effect size of .81 ($p < .001$). Participant 3 was slower to respond to the intervention. After four intervention sessions, he showed a response to the independent variable with scores between 90% and 100% on the reading comprehension measures in sessions five through ten with a medium individual *TAU* effect size ($TAU = .85$; $p < .001$). However, when comparing the effects from baseline to intervention, the positive response of data patterns and replications across participants, indicated a positive experimental effect, which is supported by *TAU-U* and *BC-SMD* ($TAU-U = .86$; $p < .01$; $BC-SMD = 1.87$). See Table 5 for baseline and intervention reading comprehension measures and individual effect sizes.

Maintenance-phase data points were collected two weeks and four weeks post intervention. Participant 1 scored 90% and 100% on the comprehension measure for both post intervention data points respectively. Participant 2 scored 90%% on both comprehension measures for the two-week maintenance check. Both students demonstrated consistency with their performance as compared to the intervention phase. Participant 3 scored 70% and 80% on the reading measure for first and second post intervention data points, which is lower than the last six data points in the intervention phase.

Literal Comprehension Questions

Each reading comprehension measure contained six literal comprehension question, meaning that the answers to the questions were explicitly stated within the text. In breaking down the reading comprehension measures to investigate the if there was an experimental effect between baseline and intervention phases, we found that Participant 1 ($TAU: .92, p < .001$) and Participant 2 ($TAU: .90, p < .001$) had large individual TAUs, while Participant 3 demonstrated a medium effect ($TAU: .68, p < .01$). Overall, between cases, there was a medium effect on literal comprehension ($TAU-U: .83, p < .001$; $BC-SMD: 1.83$). See Figure 5 for visual analysis of literal comprehension questions.

Inferential Comprehension Questions

Each reading comprehension measure contained four inferential comprehension questions, meaning that the answers to the questions were not explicitly stated within the text and had to be inferred. In breaking down the reading comprehension measures to investigate whether there was an experimental effect between baseline and intervention

phases, we found that Participant 1 ($TAU: .48, p = .14$) and Participant 2 ($TAU: .41, p = .14$) had small, but nonsignificant individual TAUs, while Participant 3 demonstrated a significant medium effect ($TAU: .61, p < .01$). Overall, between cases, there was a small effect on inferential comprehension ($TAU-U: .50, p < .001$; $BC-SMD: 1.16$). See Figure 6 for visual analysis of inferential comprehension questions.

Social Validity

At the conclusion of the intervention, each participant completed a post-intervention survey. The survey queried whether the students felt the funnel map helped them understand what they read and helped them during the reading process. Students were also asked if they would use the funnel map in classes outside of the intervention. Finally, students gave their opinion on what they liked and disliked about the intervention. All three students strongly agreed that they felt that the funnel map helped them understand and remember what they read. Participants 1 and 2 strongly agreed that they would use the funnel map in classes. When asked their opinion of likes and dislikes of the intervention, Participants 1 and 3 stated that they liked using the graphic organizer because it made it easier to find information rather than reading back through the text. Participant 2 stated that she liked listing the key details of each paragraph and then referring back to the funnel map when answering questions because it made remembering what was read easier. When asked what they did not like about the intervention, Participant 1 stated that the amount of writing that went into building the funnel map was tiring. In a similar vein, Participant 3 felt that it took a long time to build the funnel map. Overall, the students found the intervention helpful and beneficial to the reading of

descriptive texts. However, Participant 2 stated that she liked everything about the intervention and would not have changed anything.

Discussion

The purpose of this study was to determine if the funnel map graphic organizer would improve the reading comprehension of middle school bilingual learners with LD. Results suggested that Spanish-English bilingual students with learning disabilities benefitted from learning to use the funnel map to help comprehend descriptive expository texts. Moreover, in a relatively short period of time, students were able to use the funnel map to respond correctly to comprehension questions about the text. Two students quickly grasped the concept of the funnel map which had a direct impact on their comprehension scores. While the third student took longer, his comprehension scores began to improve by the fifth session. Furthermore, using the funnel map, two participants were able to accurately synthesize key details to correctly identify the main idea within two sessions. These improvements in identification of the main idea and reading comprehension scores likely occurred because the funnel map allowed students to see the key details from text all together in the graphic organizer. Results indicated that each of the students made modest increases in reading comprehension from the baseline phase through the intervention phase. Medium TAU-U effects sizes were observed for the three participants on the reading comprehension measures. We saw positive changes in reading comprehension scores only after the intervention was implemented.

Of particular note is the variability in the baseline scores on the reading comprehension measures across the three students. Several factors may have contributed

to this variability. First, students' background knowledge may have played a role. Given that background knowledge is a strong predictor of reading comprehension (Cromley & Azevedo, 2007; Oakhill & Cain, 2012; O'Reilly et al., 2019; Scarborough, 2001), students' varying background knowledge about the texts may have contributed to the variability. However, we anticipated that background knowledge would vary by passage topic. To address this, we randomly assigned the passages to mitigate any passage order effect that may have resulted from varied background knowledge.

Another factor that may have played a role in baseline variability is we were not able to establish the relative equivalence of measures in a large group of students. Similarly, some questions in each text are invariably more difficult to answer than others. A close examination of the data showed that on two passages (Sojourner Truth and William Wilberforce) students scored higher on the inferential questions than the literal questions, despite our efforts to make question difficulty as similar as possible across passages.

Importantly however, from the baseline phase through the intervention phase variability in reading comprehension scores decreased substantially. Students 1 and 2 had much more stable scores in the intervention phase, which may be a direct result of learning to use the funnel map while reading descriptive texts and using it to answer comprehension questions. This suggests that when students have a visual display of information read in a passage, they may not need to rely as heavily on their background knowledge or memory to answer comprehension questions. Student 3 showed variability in the initial sessions of intervention phase. However, at session five, he began to grasp

the concept of the funnel map. After session four, he maintained stable scores on the reading comprehension measures.

Another interesting observation was the differential effects of the funnel map on literal and inferential questions. The intervention had a larger effect on literal than inferential questions, but we expected the opposite. Inferential comprehension requires the reader to draw upon prior knowledge and integrate that knowledge with relevant information presented in the text. We were encouraged to find a small, but significant effect from baseline to intervention for inferential comprehensions, leading us to believe that the funnel map supported both literal and inferential comprehension.

Implications for Practice

Interventionists and teachers of bilingual students with reading difficulties need strategies to increase students' reading comprehension. This study contributes to the research literature by examining the use of the funnel map to enhance reading comprehension of descriptive text structures. The results of this study show that explicit instruction in the use of the funnel map when reading descriptive texts was beneficial for all students in the study and offered initial evidence that the funnel map may be effective at improving reading comprehension for Spanish-English bilingual students with LD. This study builds on the previous single case design study by Calvin and Gray (2020) that demonstrated the efficacy of using of a double bubble map graphic organizer to improve reading comprehension of compare/contrast expository texts in Spanish-English bilingual students with LD. Together these two studies provide causal evidence that graphic organizers can improve students' comprehension of expository texts.

An advantage of this intervention was that it was implemented with fidelity by undergraduate students with no teaching experience. The use of scripting for lessons makes it possible for trained tutors or teaching assistants to deliver the intervention to students. Additionally, the treatment effect occurred quickly, showing the efficiency of the intervention.

A next step is to determine whether teachers and reading interventionists could incorporate graphic organizers into their classroom instruction with good effect and whether students who learn to use graphic organizers can continue to do so for expository texts in all of their classes.

Study Strengths and Limitations

One of the strengths of this study is that fidelity of implementation was high. This was achieved through a scripted lesson plan that research assistants followed for all intervention sessions. A second strength was the use of an independent analyst, who was not aware of the study's purpose, to determine a stable baseline and growth during the intervention phase. Third, this study met criteria established by the WWC (2010) for single case designs. We demonstrated three replications of results across phases and five data points in each phase. Finally, the intervention proved to be economical in terms of how quickly participants learned to use the funnel map. One participant successfully created a funnel map after only one session and the other two participants achieved 80% accuracy or higher after four sessions. Additionally, as the accuracy of the funnel map increased, scores on the reading comprehension measures increased, indicating that this intervention was effective for all participants.

One limitation of this study is that we used researcher-developed reading passages and measures. While the reading passages were leveled and the complexity was standardized, we did not test the relative equivalence of the measures in a pilot study. To help avoid a systematic effect of difficulty we randomly assigned the reading passages and their corresponding measures across participants. Another limitation of the study was the location of the intervention. Because of COVID-19, the intervention was delivered virtually. While participants had experience with online learning for 18 months preceding the study, some students may have benefitted more from face to face explicit instruction. Finally, the small sample size in this study limits the generalizability of the findings

Conclusion

This study provided efficacy data for an instructional method to improve the reading comprehension of Spanish-English bilingual learners with reading difficulties. Based on the TAU-U effect size, the effects of the funnel map on the overall reading comprehension benefited all students. The TAU-U effect size also showed a benefit to both literal and inferential comprehension. Thus, the general use of the funnel map when reading descriptive text structures may prove beneficial to many students, including bilingual students with learning disabilities.

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APPENDIX A

TABLES

Table 1

Family Demographics

	Mother (<i>n</i> = 3)	Father (<i>n</i> = 3)
Primary Language		
English	0	0
Spanish	2	2
Both English and Spanish	1	1
Level of Education		
Did not Finish High School	1	1
Graduated High School	0	2
Some College	0	0
Graduated College	2	0

Table 2

Descriptive Statistics

Name	Ethnicity	Gender	Grade	Age	K-BIT 2 Non- Verbal IQ	WRMT Passage Comprehension	TOWRE
Participant 1	Hispanic	Female	7	12	121	80	83
Participant 2	Hispanic	Female	8	13	118	81	79
Participant 3	Hispanic	Male	7	12	81	75	71

Note: K-BIT = Kaufman Brief Intelligence Test 2 (Kaufman & Kaufman, 2004; $x = 100$; $SD = 15$);

WRMT = Woodcock Reading Mastery Test Revised (Woodcock, 2011; $x = 100$; $SD = 15$); TOWRE:

Test of Word Reading Efficiency (Wagner, Torgesen, & Rashotte, 2011; $x = 100$; $SD = 15$)

Table 3***Descriptive Statistics for Baseline Measures Reading Passages***

Title	Lexile	Word Count	Sentence Length	Flesch-Kincaid Grade Level
George Washington Carver	900	257	12.75	6.4
Sojourner Truth	900	256	12.75	6.5
Amelia Earhart	900	257	12.75	6.6
Cesar Chavez	900	257	12.75	6.6
Pocahontas	900	257	12.77	6.7
Florence Nightingale	900	257	12.75	6.4
William Wilberforce	900	257	12.77	6.7
Mary Jane Bethune	900	257	12.75	6.5
Wilma Rudolph	900	256	12.72	6.5
Frederick Douglas	900	257	12.72	6.5
Nelson Mandela	900	256	12.72	6.7
Ruby Bridges	900	257	12.75	6.4
Mother Teresa	900	256	12.72	6.7
<i>Mean</i>	900	256.69	12.74	6.55
<i>Standard Deviation</i>	0	0.48	0.05	0.12

Table 4***Descriptive Statistics for Intervention Measures Reading Passages***

Title	Lexile	Word Count	Sentence Length	Flesch-Kincaid Grade Level
Katherine Johnson	900	256	12.76	6.7
Abraham Lincoln	900	257	12.72	6.7
Anne Frank	900	257	12.74	6.6
Harriet Tubman	900	256	12.75	6.4
Helen Keller	900	257	12.74	6.6
Malala Yousafzai	900	256	12.74	6.5
Marie Curie	900	257	12.75	6.5
Martin Luther King, Jr.	900	257	12.72	6.6
Rosa Parks	900	256	12.79	6.5
Susan B Anthony	900	257	12.74	6.5
Katherine Johnson	900	256	12.76	6.7
Abraham Lincoln	900	257	12.72	6.7
Anne Frank	900	257	12.74	6.6
<i>Mean</i>	900	256.60	12.74	6.55
<i>Standard Deviation</i>	0	0.51	0.05	0.12

Table 5

Funnel Map and Comprehension Outcome Variables and Individual Effect Sizes

	Funnel Map				Comprehension			
	BL <i>M</i> (range)	INT <i>M</i> (range)	MAIN. <i>M</i> (range)	TAU	BL <i>M</i> (range)	INT <i>M</i> (range)	MAIN. <i>M</i> (range)	TAU
Participant 1	0 (0)	85.5 (54-95)	91.75 (86-97.5)	.94**	62 (40-80)	91 (70-100)	95 (90-100)	.92**
Participant 2	0 (0)	94.3 (89-100)	92.5 (90.5 – 94.5)	.96**	66.25 (40-90)	94 (70-100)	90 (90)	.81**
Participant 3	0 (0)	59.8 (18-77.5)	62.5 (62-63)	.90**	54 (30-80)	86 (70-100)	75 (70-80)	.85**

Note:

Table outcomes reflect measures specifically created for this study.

BL = baseline mean, INT = intervention mean, MAIN = maintenance mean, TAU individual effect

size

** $p \leq 0.01$

APPENDIX B

FIGURES

Figure 1

Frederick Douglass: Example of Funnel M

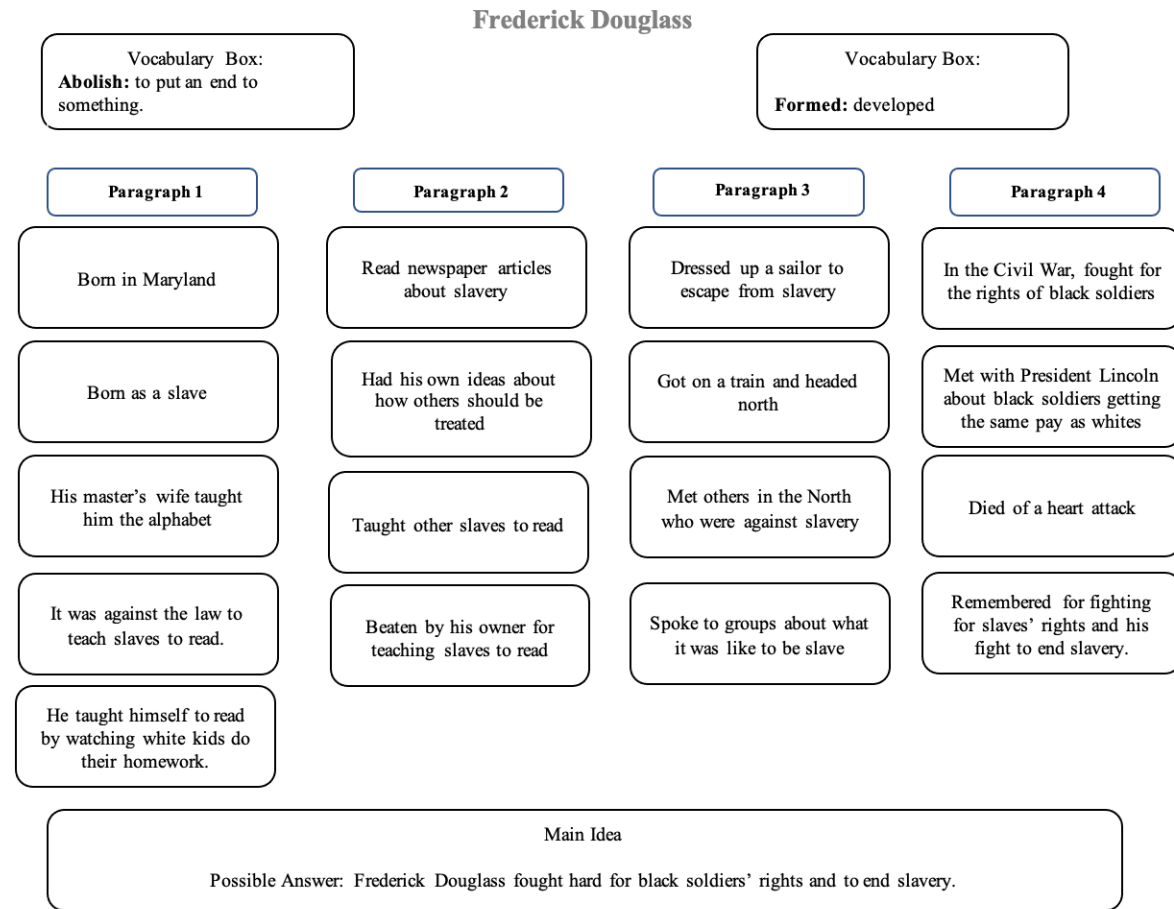


Figure 2

Percentage Correct of Funnel Map and Reading Comprehension Means

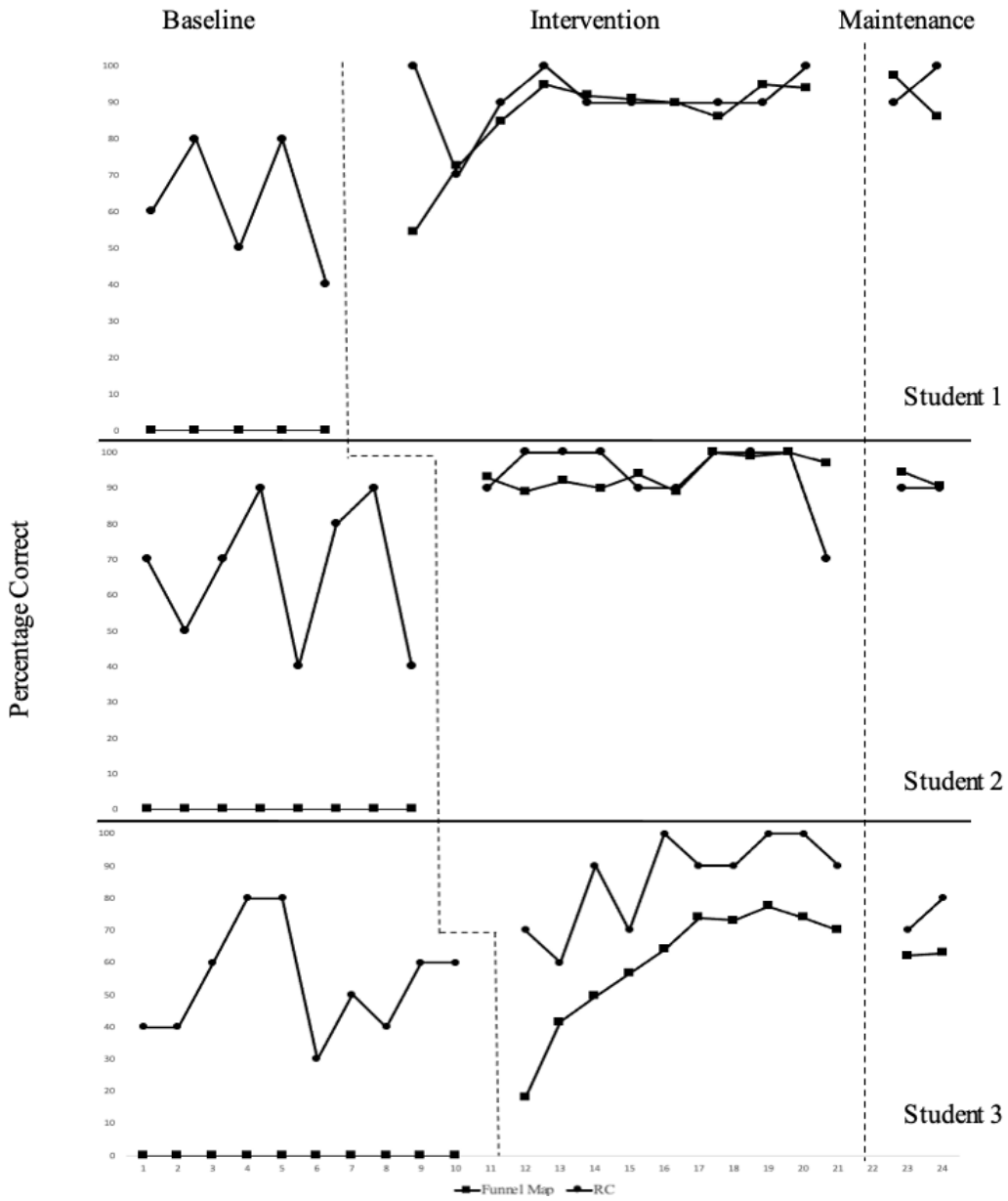


Figure 3

Visual Analysis of Intervention Effects

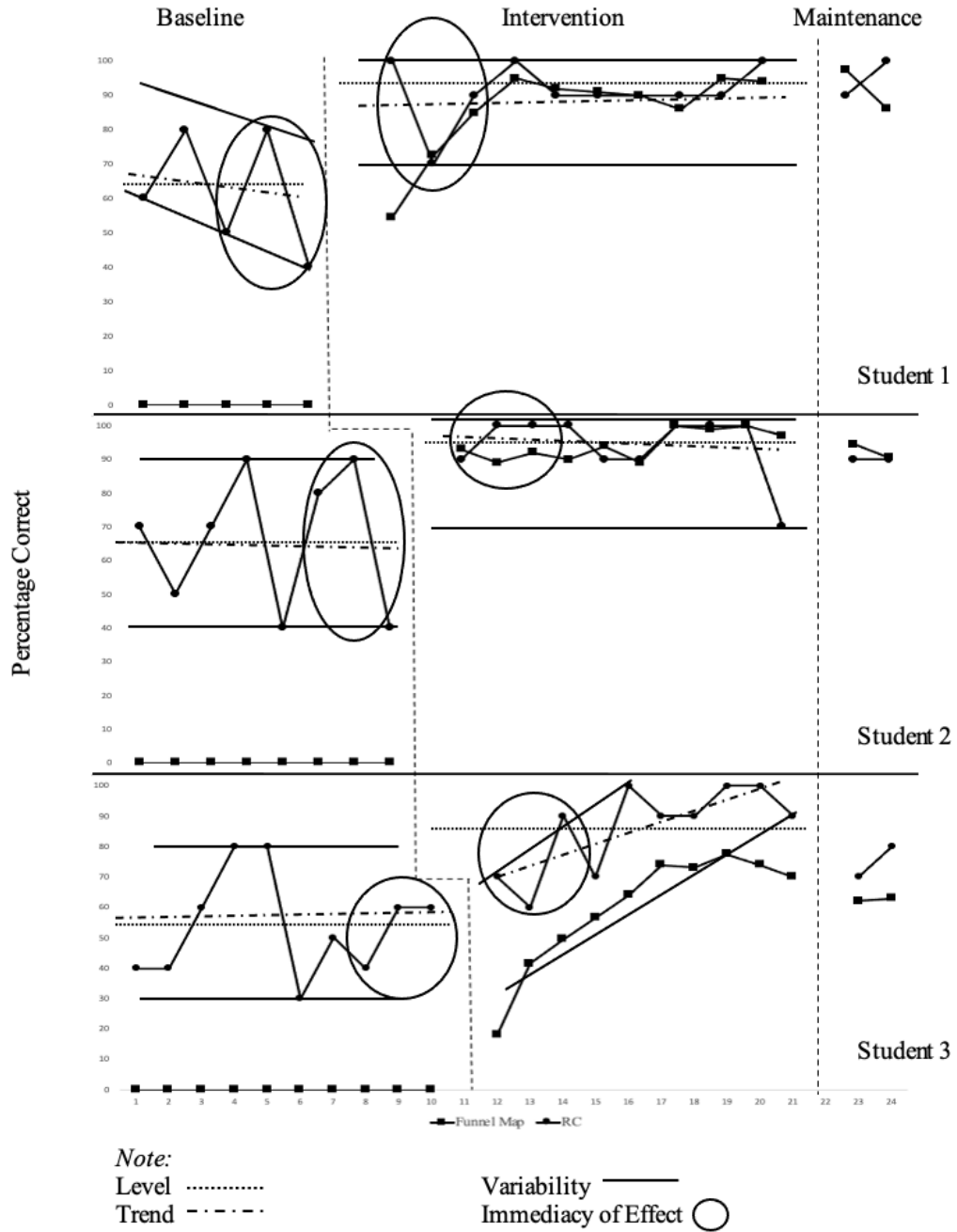


Figure 4

Percentage Correct of Key Details and Main Idea

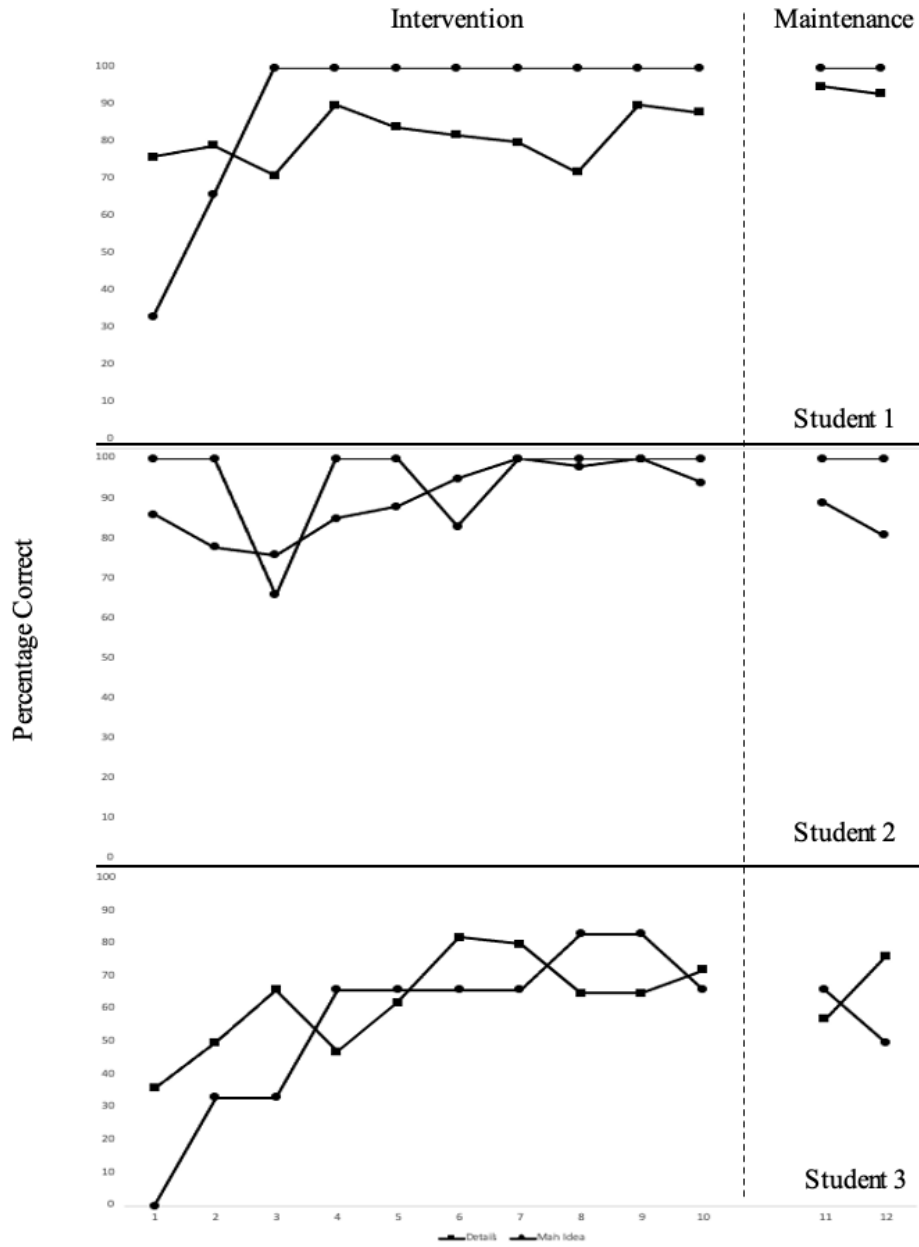
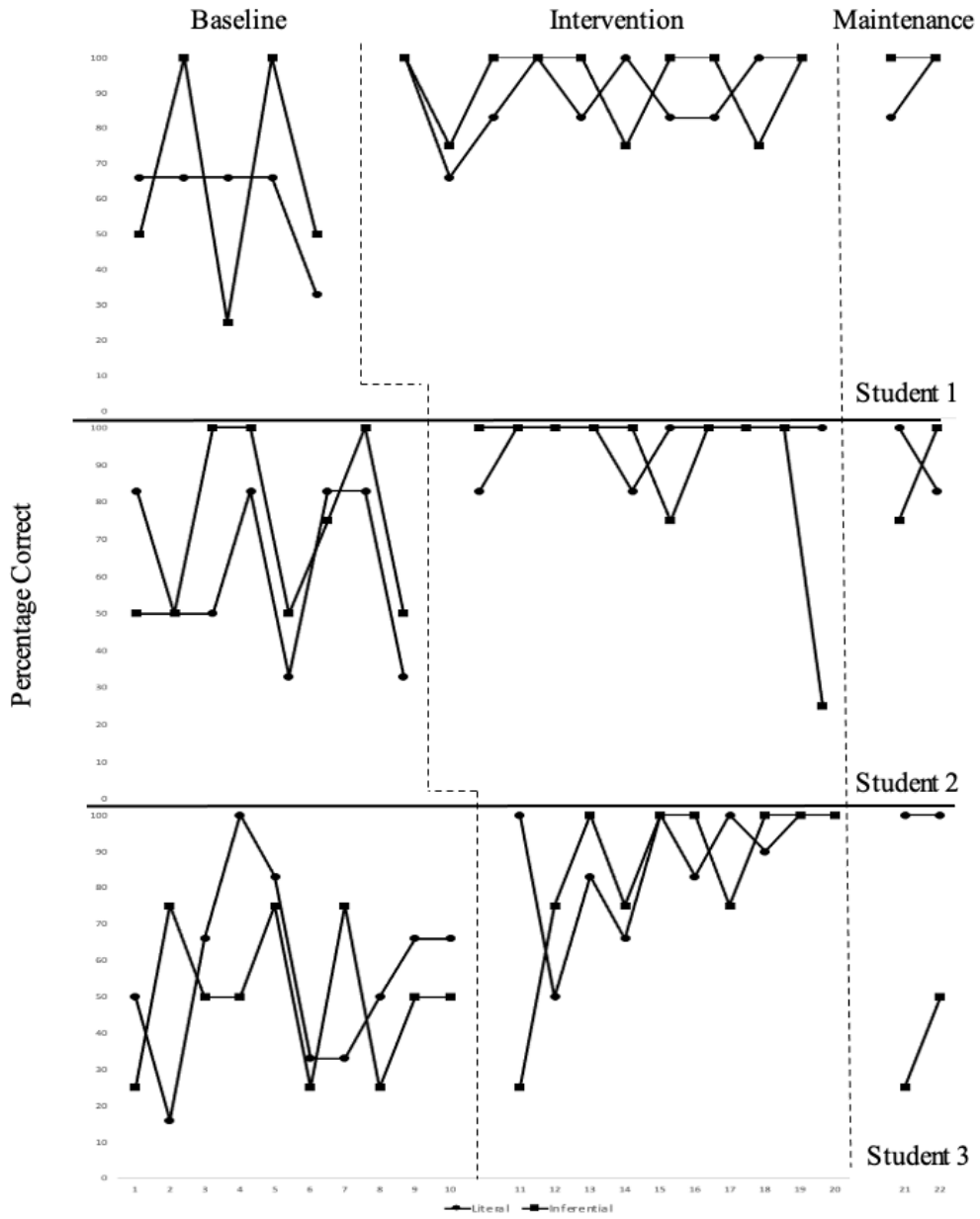


Figure 5

Percentage Correct of Literal and Inferential Questions



APPENDIX C

ARIZONA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD APPROVAL



APPROVAL: EXPEDITED REVIEW

[Shelley Gray](#)
[Speech and Hearing Science](#)
 480/965-6796
Shelley.Gray@asu.edu

Dear [Shelley Gray](#):

On 5/17/2021 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Improving Expository Text Comprehension in Adolescent Spanish-English Bilingual Learners with Learning Disabilities
Investigator:	Shelley Gray
IRB ID:	STUDY00013941
Category of review:	(7)(a) Behavioral research
Funding:	Name: US Department of Education (DOEd), Grant Office ID: AWD00031954, Funding Source ID: H325D170061
Grant Title:	AWD00031954;
Grant ID:	AWD00031954;
Documents Reviewed:	<ul style="list-style-type: none"> • Background Knowledge Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Consent for the Release of Records, Category: Consent Form; • Cover Letter, Category: Recruitment Materials; • COVID 19 Schooling Survey, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • DIBELS Reading Passages, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • DIBELS Scoring Sheet, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

	<ul style="list-style-type: none"> • DNQ Letter, Category: Other; • GAN Year 2 GAN_R305A170068.1.1-1 (1).pdf, Category: Sponsor Attachment; • KBIT-2, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Parent Questionnaire, Category: Screening forms; • Parental Consent Form, Category: Consent Form; • Phone Script, Category: Recruitment materials/advertisements /verbal scripts/phone scripts; • Pretest/Posttest Research Created Reading Comprehension Sample, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • QRI, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Recruitment Flyer, Category: Recruitment Materials; • REVISED Calvin_Kristie_IRB_Protocol_5_17.docx, Category: IRB Protocol; • Sample Intervention Comprehension Questions, Category: Participant materials (specific directions for them); • Sample Intervention Graphic Organizer, Category: Participant materials (specific directions for them); • Sample Intervention Lesson Plan, Category: Technical materials/diagrams; • Sample Intervention Reading Passage, Category: Participant materials (specific directions for them); • Social Validity, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • Student Assent Control Condition, Category: Consent Form; • Student Assent Treatment Condition, Category: Consent Form; • TOWRE, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • WJ-III Passage Comprehension, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);
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The IRB approved the protocol from 5/17/2021 to 5/16/2022 inclusive. Three weeks before 5/16/2022 you are to submit a completed Continuing Review application and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 5/16/2022 approval of this protocol expires on that date. When consent is appropriate, you must use final, watermarked versions available under the "Documents" tab in ERA-IRB.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

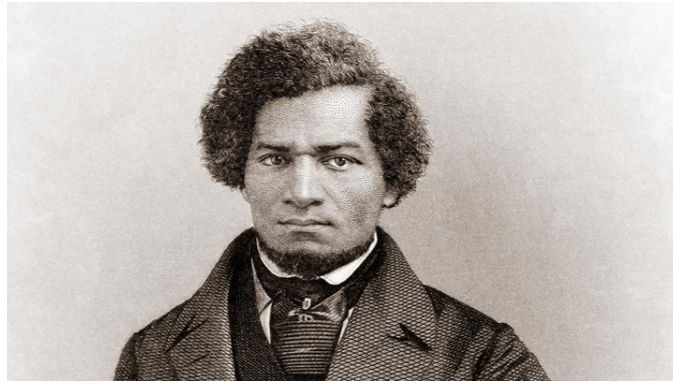
Sincerely,

IRB Administrator

cc: Kristie Calvin
Kristie Calvin
Shelley Gray

APPENDIX D

READING COMPREHENSION PASSAGE SAMPLE



Frederick Douglass was born as a slave in 1818 in Maryland. At a very young age, he was sold to another slave owner. When Frederick was 12 years old, his master's wife, Sophia, began to teach him the alphabet. At that time, it was against the law to teach slaves to read. When his master found out what his wife was doing, he stopped her from teaching Frederick. However, Frederick was smart, and he taught himself to read and write by watching white children do their homework.

Once Frederick learned to read, he read newspaper articles about slavery and he quickly **formed**, or developed, his own views about how people should be treated. He taught other slaves how to read. Unfortunately, this got him in trouble, and he was beaten by his owner. However, this encouraged Frederick to continue fighting for his freedom.

In 1838, Frederick planned his escape. He dressed up like a sailor and carried papers that said he was a free black man. He boarded a train and traveled north. Living in the north, Frederick met other people who were against slavery. The people wanted to **abolish**, or end, slavery. Frederick spoke to groups and shared his experiences as a slave.

During the Civil War, Frederick fought for the rights of black soldiers. He met with the President Lincoln and insisted that black soldiers get the same pay as white soldiers. Frederick Douglass died in 1895 from a heart attack and is remembered for fighting for slaves' rights and his support to end slavery.

Lexile: 900

Word Count: 257

Grade Level: 6.5

Mean Sentence Length: 12.70

APPENDIX E
MAIN IDEA RUBRIC

Main Idea Rubric

3	<ul style="list-style-type: none">• Synthesizes the main idea of the passage.
2	<ul style="list-style-type: none">• Synthesizes one or two details of the passage.
1	<ul style="list-style-type: none">• Retells the story with key details with no synthesizing.
0	<ul style="list-style-type: none">• Does not retell the story or only states the topic of the passage.

APPENDIX F

READING COMPREHENSION ASSESSMENT SAMPLE

Choose the answer that best answers the question:

1. What did the master's wife do for Frederick that got her in trouble?
 - a. She taught him the alphabet so that he could learn to read.
 - b. She gave him special food that was meant for white children.
 - c. She punished him for learning to read.
 - d. She made special clothes for him.

2. What was against the law during that time?
 - a. Teaching white children to read
 - b. Talking to slaves
 - c. Teaching slaves to read
 - d. Having slaves work on a farm

3. How did Frederick learn to read?
 - a. He watched a video on reading.
 - b. He watched white children doing their homework.
 - c. His master's wife taught him.
 - d. He went to a school for African American children.

4. What did Frederick read that help shape his views on how people should be treated?
 - a. Books about slavery
 - b. Poems
 - c. Music by slaves
 - d. Newspapers

5. What did Frederick do that got him in trouble with his owner?
 - a. Taught other slaves to read
 - b. Worked too slow
 - c. Showed up to work late
 - d. Fell asleep while working

6. What does "abolish" mean in this sentence: Frederick worked hard to **abolish** slavery.
 - a. To allow something to happen
 - b. To put an end to something
 - c. To keep something that is special
 - d. To throw something useless away

7. Why did Frederick dress up like a sailor?
 - a. He wanted to hide his identity so he could escape slavery.
 - b. He wanted to join the Navy to fight to end slavery.
 - c. He wanted to play a trick on his family.
 - d. He liked to dress in a uniform while he worked.

8. Why was it important for Frederick to meet with other people who wanted to end slavery?
 - a. It gave them an opportunity to complain about slavery.
 - b. United together, they could fight to end slavery.
 - c. They liked to read newspapers together.
 - d. They ate dinner together and sang songs.

9. Why were black soldiers paid less than white soldiers?
 - a. Black soldiers did not fight in battles.
 - b. White soldiers worked harder.
 - c. The government did not value the work or the lives of black soldiers.
 - d. White soldiers were from wealthy families.

10. What is the main idea of this passage?
 - a. Frederick worked hard for equal rights of black soldiers and to end slavery.
 - b. Frederick taught himself to read.
 - c. Frederick escaped to the North by dressing up as a sailor.
 - d. Frederick was punished for learning to read.

APPENDIX G
SOCIAL VALIDITY SURVEY

Administration Directions

Say, "I am going to read some sentences to you. I want to know how you feel about reading. There are no right or wrong answers. I really want to know how YOU honestly feel about reading. I will read each sentence twice. You can mark your answer by checking the choice that is best for you. The first time I read the sentence, I want you to think about the best answer for you. The second time I read the sentence, I want you to pick your best answer. Be sure to mark only one answer. OK, let's begin."

1. The funnel map helped me understand what I read.
 - Strongly Disagree
 - Disagree
 - Agree
 - Strongly Agree
2. I liked using the funnel map while I was reading.
 - Strongly Disagree
 - Disagree
 - Agree
 - Strongly Agree
3. I feel that the funnel map will help me complete your schoolwork.
 - Strongly Disagree
 - Disagree
 - Agree
 - Strongly Agree
4. I will use funnel map in my other classes.
 - Strongly Disagree
 - Disagree
 - Agree
 - Strongly Agree
5. What did you like most about funnel map strategy?
6. What did you like least about funnel map strategy?

7. I will recommend the funnel map to my friends.

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

8. I would like to know more about graphic organizers.

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

9. I liked working in groups.

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

10. Working in groups kept me from learning.

- Strongly Disagree
- Disagree
- Agree
- Strongly Agree

APPENDIX H
FIDELITY CHECKLIST

Fidelity Checklist

<i>FIDELITY CHECKLIST</i> ELEMENT	L E V E L O F P E R F O R M A N C E			
	UNSATISFACTORY 1 POINT	DEVELOPING 2 POINTS	EFFECTIVE 3 POINTS	HIGHLY EFFECTIVE 4 POINTS
Setting the Stage: 1. Provided a brief review of the previous lesson. 2. Engaged students by telling them what they were going to learn in that session	The instructor covered none of the suggested scripts in Setting the Stage.	The instructor covered some of the suggested scripts in Setting the Stage.	The instructor covered most of the suggested scripts in Setting the Stage.	The instructor covered all aspects of the suggested script in Setting the Stage.
I Do: 1. Modeled the skill that students were learning that session. 2. Followed the suggested script	The instructor did not model the skills and covered none of the suggested script in I Do.	The instructor modeled some of the skills and covered some of the suggested script in I Do.	The instructor modeled most of the skills and covered most of the suggested script in I Do.	The instructor modeled all the skills and covered <u>all of</u> the suggested script in I Do.
We Do: 1. Provided the student the opportunity to engaged in guided practice of the skill learned during that session. 2. Followed the suggested script	The instructor did not provide time for guided practice and covered none of the suggested script in We Do.	The instructor provided some time for guided practice and covered some of the suggested script in We Do.	The instructor provided time for guided practice and covered most of the suggested script in We Do.	The instructor provided ample time for guided practice and covered <u>all of</u> the suggested script in We Do.
You Do: 1. Provided the student the opportunity to engaged in independent practice of the skill learned during that session. 2. Followed the suggested script	The instructor did not provide time for independent practice and covered none of the suggested script in You Do.	The instructor provided some time for independent practice and covered some of the suggested script in You Do.	The instructor provided time for independent practice and covered most of the suggested script in You Do.	The instructor provided ample time for independent practice and covered <u>all of</u> the suggested script in You Do.
Closure: 1. Reviewed the key concepts taught 2. Followed the suggest script	The instructor did not review the key concepts taught in the lesson and covered none of the suggested script in Closure.	The instructor reviewed some of the key concepts taught in the lesson and covered some of the suggested script in Closure.	The instructor reviewed most of the key concepts taught in the lesson and covered most of the suggested script in Closure.	The instructor reviewed <u>all of</u> the key concepts taught in the lesson and covered all of the suggested script in Closure.

APPENDIX I
LESSON PLAN

Lesson 7

Frederick Douglass: Main Idea and Supporting Details

Objectives:

1. Student will create a funnel map in response to a reading passage.
2. Student will identify the main idea and supporting details.
3. Student will identify vocabulary words and their meanings.
4. Student will answer comprehension questions.

AZ ELA Standard: 7.RI.3 Analyze the interactions between individuals, events, and ideas in a text (e.g., how ideas influence individuals or events, or how individuals influence ideas or events).

Text:

Frederick Douglass

Vocabulary:

Abolish: to put an end to something.

Materials:

1. Copies of the text
2. Pencils
3. Blank Paper
4. 2 Copies of Comprehension Questions

Setting the Stage (5 minutes)

1. *Say something similar to this:*
 - Yesterday, we read a passage about Wilma Rudolph.
 - We used a funnel map to take notes while we read.
 - We used the details from our funnel map to determine the main idea and answer questions about the passage.
 - Today, we will read a passage about Frederick Douglass. We will use the funnel map to take notes and find the main idea. Then, we will answer some questions about the passage we read.

I Do: Identifying the Main Idea and Supporting Details (10 minutes)

1. Review vocabulary words before reading the passage.
2. *Say something similar to this:*
 - Every passage we read in school or for pleasure has a main idea.
 - The main idea of a passage is the point of the passage. It is the most important thought about the topic.
 - To figure out the main idea, ask yourself this question: What is being said about the person, thing, or idea (the topic)?
 - The author may not explicitly tell us the main idea. We may have to figure it out on our own.
 - To help us organize our thoughts while we read, we will create a funnel map. We will use the funnel map to take notes on each paragraph and write down important vocabulary words and their meanings.
3. *Say something similar to this:*
 - Listen as I read the passage about Frederick Douglass. (Read the passage aloud to the student).
 - Now, I am going to read the first paragraph again and begin to create a funnel map.
 - The first paragraph tells us that Frederick was born as a slave in Maryland. I am going to write that as my first detail. I am going to put it in my own words instead of writing the entire sentence.
 - I also read that Frederick was taught the alphabet by his master's wife. I am going to write that as my second detail. I am going to put that in my own words instead of writing the entire sentence.
 - I also learned that it was against the law to teach slaves to read. I'll put that as my next detail.
 - Finally, I read that he taught himself to read by watching white children do their homework. I will write that as my last detail of the first paragraph.
 - Continue doing this for each of the paragraphs. Use the premade funnel map as a guide.
 - Identify the main idea.
1. *Say something similar to this:*
 - Now I'll answer some questions about what I've have read. (Read the comprehension questions and potential answers. Answer the questions using the funnel map).
 - The first question asks, "What did the master's owner do for Frederick that got her in trouble?"
 - Looking at our funnel map, we see that she taught him the alphabet so that he could learn to read. So, I will choose answer "A." (Continue answering the questions in this fashion together).

We Do: Identifying the Main Topics, Similarities and Differences (10 minutes)

2. Give the Student a blank piece of paper.
3. *Say something similar to this:*
 - Let's read the passage about Frederick. (Read the passage aloud with the student).
 - Now, let's read the first paragraph again and begin to create a funnel map.
 - The first paragraph tells us that Frederick was born as a slave in Maryland. I am going to write that as my first detail. I am going to put it in my own words instead of writing the entire sentence.
 - The first paragraph also says that the master's wife taught Frederick the alphabet. Let's put that in your own words instead of writing the entire sentence. (If the student struggles, help them with their word choices.)
 - Continue doing this for each of the paragraphs. Use the premade funnel map as a guide. **Don't forget to create vocabulary boxes for the bolded words.**
 - Now that we have finished the funnel map, let's see if we can find similarities in the details.
 - The details tell us that Frederick was born a slave. At the time, it was illegal to teach slaves to read, but Frederick taught himself by watching white children do their homework. After escaping, Frederick met people who wanted to end slavery. He even met with the president to get equal pay for black soldiers.
 - Now, let's put the main idea into your own words. (If the student struggles, help them with their word choices. Refer to the funnel map if you need help.)
4. *Say something similar to this:*
 - Now let's answer some questions about what we've have read. (Read the comprehension questions and potential answers. Answer the questions using the funnel map).
 - The first question asks, "What did the master's owner do for Frederick that got her in trouble?"
 - Looking at our funnel map, we see that she taught him the alphabet so that he could learn to read. So, I will choose answer "A." (Continue answering the questions in this fashion together).

You Do (10 minutes)

1. Remove the model map from the student before starting I Do.
2. *Say something similar to this:*
 - You did a great job!
 - As we read the passage, I want you to use a blank piece of paper to draw and label funnel map. If you need help, just let me know and I will help you.
 - When you are finished reading and drawing your funnel map, you will answer the questions about the passage using your double-bubble map.
3. If the student struggles with completing the task independently, please support them by referring back to the We Do section. The goal is for them to learn how to use the funnel map independently while reading. Provide support, if needed. But, please give them as much independence as possible.
4. If you do provide support, please write “support provided” that on the back of the map or questions.
5. When Student are finished, collect the maps and questions and return to Kristie.

Closure (5 Minutes)

1. *Say something similar to this:*
 - Today we learned how to create a funnel map when reading a passage.
 - We used a funnel map to help us organize what we read about Frederick Douglass.
 - We learned how to find important details in each paragraph and then use those details to help us find the main idea.

Practice Assessment (10 minutes)

1. *Say something similar to this:*
 - You did a great job!
 - This time we will read the passage on X together. (The randomly assigned passage will be included in the lesson plan packet).
 - As we reread the passage, I want you to create a funnel map and fill it in with the details and main idea.
 - Then, you will answer comprehension questions about the passage.

DO NOT HELP THEM WITH ANYTHING OTHER THAN READING WORDS.