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THE EFFECTIVENESS OF GRAPHIC ORGANIZERS IN IMPROVING READING COMPREHENSION FOR STUDENTS WITH LEARNING DISABILITIES IN MIDDLE SCHOOL: A REVIEW OF LITERATURE

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Reading comprehension is a challenge for adolescents with learning disabilities, particularly with respect to comprehending expository texts. The present literature review analyzes the importance of using graphic organizers (GOs) to improve reading comprehension for students with learning disabilities (LD). A systematic review was conducted to investigate the effectiveness of GOs to assist middle school students with LD improve their reading comprehension. The review covered 11 studies published between 1990 and 2013, which were coded and analyzed. Of these studies, nine provided evidence that GOs help students with LD with reading comprehension. However, three studies found no significant differences in the performance levels of students with LD. Implications for practice are discussed.

Keywords: graphic organizers, reading comprehension, learning disabilities, middle school.

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CHAPTER 1

INTRODUCTION

Students with learning disabilities (LD) may face many difficulties in their transition from elementary school to middle school. During this transitional phase, students are exposed to academic content that is more complex and typically above their reading ability (Tiffany & Tejero, 2015). Sam and Rajan (2013) claimed that students with LD typically face major reading challenges because they are worried "about understanding every single word of a text" and, thus, "do not get the general idea from the passage" (p. 155). According to Kim, Vaughn, Wanzek, and Wei (2004), many students with learning disabilities (LD) have difficulties connecting newly attained information to prior knowledge, identifying main ideas and supporting details, and drawing inferences. Furthermore, Gajria, Jitendra, Sood, and Sacks, (2007) stated that textbooks lack organizational clarity and are generally above the reading ability of the focal grade level. For these reasons, students with LD face challenges interpreting and comprehending texts and need explicit content enhancements to assist their comprehension. Furthermore, Sabbatino (2004) noted that some middle school students with LD "lack the skills necessary to read and identify key concepts in textbooks" and may have difficulties paying attention during reading (p. 70). These issues inevitably may impact students' achievement because "reading comprehension requires the ability to decode words, read fluently, and use active strategies to understand the meaning of complex text" (Tiffany & Tejero, 2015, p. 414). Hence, students with LD need appropriate learning strategies to help them comprehend what they read across disciplines (Dye, 2000). One commonly known such strategy is referred to as graphic organizers (GOs).

GOs are organizational tools implemented during instruction to help students to understand complicated information. Gallavan and Kottler (2007) described GOs as "visual

models, which provide teachers with tools, concepts, and language to organize, understand, and apply information to achieve a variety of purposes and outcomes" (p. 117). GOs can be spatial and visual displays intended to facilitate learning by helping students make sense of complicated information, which, in turn, can improve students' understanding and ability to decipher relationships among prior knowledge of terms, facts, and ideas with new information (Dexter et al., 2011; Mede, 2010). Teachers can use GOs to illustrate a student's knowledge about a topic or section of text and highlight areas for improvement. According to Pang (2013), "graphic organizers have been widely used by teachers to help students organize and summarize content, classify facts, and analyze and compare contents they read" (p. 3).

Scruggs, Mastropieri, and Okolo (2008) suggested that using GOs can provide multiple benefits for students with disabilities. GOs can help students access and understand the content being taught. They allow students to "represent facts, concepts, and relationships among ideas to support conceptual learning" in the classroom (Scruggs, Mastropieri, & Okolo, 2008, p. 12–13). Moreover, GOs can reduce the cognitive demand on learning and aid in recalling information. Using GOs, therefore, can help students with learning disabilities (LD) organize content in a clear and concise manner by taking notes and retaining information. GOs assist to process the information by visually representing them. They also help students master critical thinking skills and foster higher-level thinking skills by asking them to recall, evaluate, synthesize, analyze, and apply what they have learned (Cleveland, 2005). GOs can be versatile tools for classroom use as they offer a means to visually present a wide range of material. GOs can contribute to improved test scores by helping students understand relationships among key ideas and improving their focus as they study (Cleveland, 2005). GOs are highly recommended for helping students with LD read well, grasp meaning, and understand the relationships among concepts across subject

areas (Kim, Vaughn, Wanzek, & Wei, 2004). GOs can take various forms, including: *semantic maps, structured overviews, concept maps, semantic organizers, story maps, Venn diagrams, tree diagrams, knowledge maps,* and *matrix*es (Sam & Rajan, 2013).

Jiang and Grabe (2007) stated that there are many ways to implement GOs that can improve students' performance in reading comprehension and can be used in all reading stages (i.e., pre-reading, during reading stage, and post-reading). GOs can be constructed in three ways: teacher-constructed, student-constructed, and teacher/student constructed. The way in which a GO is constructed is crucial for enhancing comprehension of text (Manoli & Papadopoulou, 2012).

GOs can be presented before, during, or after a class lesson. First, students can use GOs before a lesson to activate prior knowledge, guide thinking, develop vocabulary, introduce or preview a topic or issue, brainstorm ideas, and motivate interest. Second, during a lesson, GOs can help students organize information and stay focused on the content, provide useful tools for note-taking, retaining information, checking, extending, and highlighting important ideas. Third, after a lesson, GOs allow students to confirm or rethink prior knowledge and to relate new concepts to former concepts. Moreover, GOs are used to review, reinforce, and assess learning and to establish a foundation for future projects and activities (Gallavan & Kottler, 2007; Manoli & Papadopoulou, 2012).

Merkley and Jefferies (2000) suggested a set of guidelines for the successful implementation of GOs. The first step is to verbalize relationships among visually expressed concepts. In other words, remind students that the GO is an overview of the material that will be read. In the second step, the teacher provides opportunities for student input and involvement during class discussions. In the third step, the teacher connects new and prior knowledge. The

fourth step involves making expectations about upcoming readings. Finally, the last step involves helping students decode the text and make sense of what was read or learned.

Another view concerning the implementation and usage of GOs was proposed by Baxendell (2003), who suggested three key factors that make GOs effective: consistency, coherency, and creativity. Consistency refers to presenting information in a routine and structured manner across all subject areas. Consistency also increases content retention and improves students' organizational skills by creating a standard set of GOs and establishing a routine method of implementing them in the classroom. For instance, a teacher may develop a standard sequence chart for all subject. Sequence charts are used to examine a sequence of events and encourage students to independently practice organizing techniques. For example, a standard model of sequence charts can be organized in a main-idea-and-detail organizer.

The second key factor, coherence, refers to presenting the GO using a straightforward approach by making abstract concepts and relationships more understandable. Design should be free of distracting texts and visuals and clearly labelling ideas and concepts. For instance, in a main-idea-and-detail chart, the main idea should be placed at the center and linked to related concepts using arrows and lines. Labels should be included to help the students understand the GO's content. The third key factor, creativity, refers to presenting a GO in an inviting manner. Creative GOs are more likely to facilitate information retention, especially among students with difficulty focusing or paying attention for long periods of time. Creativity can be achieved by using GOs during homework and test reviews, adding illustrations, and implementing cooperative groups and learning pairs. For example, GOs that have previously been used in the classroom can be modified and used again for homework and test reviews (e.g., by asking students to fill in missing information). Pictures can be added to facilitate retention, especially

among students with special needs, who prefer the visual modality for learning (Baxendell, 2003).

Dye (2000) suggested four basic steps for implementing GOs. First, teachers should determine what information is essential to present to their students. Second, teachers should select the key components that their students need. Third, teachers should create an appropriate graphic representation of that information to help students understand the concept in a clear and concise way. Last, by examining the information in the GO, teachers should help their students understand connections among concepts (Dye, 2000). Although the implementation techniques of GOs vary, the goal remains the same: to provide students with a means for making connections, thinking critically about the material, enhancing comprehension, and becoming more independent learners.

This literature review focuses on GOs as strategies to improve students' reading comprehension skills. It will specifically investigate research findings regarding the effectiveness of GOs to help middle school students with LD.

Research question:

(1) What is the effect of using GOs on the reading comprehension skills of students with LD in middle school?

CHAPTER 2

METHODOLOGY

Literature Search Procedure

A systematic search was conducted using two search methods: an electronic search and an ancestral search. First, I conducted broad computerized searches of the empirical literature pertaining to the utilization of GOs for students with LD using the electronic databases ONESEARCH, ERIC, PsychInfo, and EBSCO. The primary search term was "graphic organizer." The secondary search terms were "learning disabilit* (-y, -ies)," OR "reading disabilit*(-y, -ies)," OR "severe reading dis*." The tertiary search term was "reading comprehension." The quaternary search terms were "effective-ness," OR "impact," OR "improvement," OR "achievement." This initial search yielded a total of 38 articles published between 1987 and 2017. The 38 articles were published in various journals, including: *Exceptional Children, Focus on Exceptional Children, Intervention in School and Clinic, Journal of Learning Disabilities, The Journal of Special Education, Teaching Exceptional Children, Learning Disability Quarterly; Learning Disabilities Research & Practice,* and *Remedial and Special Education.* Of the 38 articles, 18 were non-research-based articles that described the purpose of GOs and how to implement them. The remaining 20 articles investigated the effectiveness of GOs in improving reading comprehension for students with LD. Each of the studies was conducted at different grade levels: 4 in elementary schools, 3 in high schools, and 13 in middle schools.

Second, the reference list of each eligible article was also reviewed for an ancestral search. To find additional sources, I compared my list of articles with the reference list from Ciullo and Reutebuch's (2013) study, which concentrated on GOs' effectiveness. Only six of their articles were relevant to my research topic, and were included in the 38 sources.

Selection Criteria

To judge the appropriateness of each article, the following inclusion criteria were used. First, participating students must have been in grades 6 through 8 (middle school) and identified with a LD. I used the LD definition provided by the Individuals with Disabilities Education Act (IDEA), which defines a learning disability as "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations" (as cited in Kenneth, Lucinda & Andrea, 2009). Secondly, I focused exclusively on studies published between 1990 and 2017. Each study was conducted and presented in English. Thirdly, the independent variable was using GOs as a reading intervention. Fourthly, the dependent variable was reading comprehension, the ability to understand targeted information. Lastly, research designs included group-subject designs, meta-analyses, and systematic reviews.

Coding Study Features

The study features were coded as participant characteristics (i.e. grade level, disability type), intervention descriptions, research designs, and study results. The reviewed studies focused on students with LD, who were classified as "low-achieving students" with reading disabilities. Most studies included participants in middle school (i.e., grades 6 through 8) and used interventions including GOs in content areas.

Applying the inclusion criteria yielded a set of 13 studies. Two studies (Study 1: Alturki, 2017; Study 2: Culbert et al., 1998) were excluded because their participants did not fit the inclusion criteria (Study 1: English language learners with LD; Study 2: educators). Thus, a set of 11 studies remained for systematic review.

CHAPTER 3

LITERATURE REVIEW

The present literature review resulted in 11 studies. Of these, three were meta-analyses, one was a systematic review, and seven were group-subject designs (e.g., pretest-posttest comparison design, quasi-experimental design, true-experimental design, matched-subjects design, pretest-posttest control group design). Two were published between 1990 and 1998, and the remaining nine were published between 2000 and 2013.

Tables 1 and 2 below show the results of the analysis in detail.

Table 1: Meta-analyses and Systematic Reviews

Author Name/Date	Participants	Grade Level	Intervention Description	Findings
Ciullo and Reutebuch (2013)	12 studies including 162 students with LD	K–12	The effects of computer- based GOs on academic outcomes were examined, and integral instructional and methodological features were selected for evaluation to delineate practical implications and prioritize future research.	Computer-based graphic organizers are efficacious with the use of explicit instruction, guided practice, and extended practice opportunities with feedback. Students with LD can successfully procure information by using computer-based GOs. In social studies, researcher- developed measures that compared computer-based GOs to textbook-based conditions had high effect sizes (*ES* = .64 to 1.97). The findings also showed some promising advances in writing and some less promising results in comprehension.
Dexter, Park, and Hughes (2011)	271 students	6–12	23 standardized mean effect sizes were extracted from 6 articles involving 271 participants in grades 6 through 12.	Findings indicated that GOs improve the factual comprehension and vocabulary knowledge of intermediate and secondary students with LD in science. Furthermore, the findings indicated that GOs facilitate maintenance of learned science material for students with LD.
Dexter and Hughes (2011)	808 students	4–12	55 standardized mean effect sizes were extracted from 16 articles involving 88 participants in grades 4 through 12.	GOs are more efficient in posttest maintenance than activities like attending lectures, reading passages, and taking part in classroom practice. Therefore, GOs were recommended as instructional tools to assist students in understanding complex concepts.
Kim, Vaughn, Wanzek, and Wei (2004)	848 students with LD calculated from 21 studies	K–12	The findings of 21 group design intervention studies examining the effects of GOs on comprehension for students with LD were systematically reviewed. 18 studies used researcher-developed comprehension tests, and two included both researcher-developed tests and standardized reading tests.	When students with LD were taught to use GOs, whether by their teacher or by a researcher, their reading comprehension improved. The mean effect sizes ranged from 1.15 to 1.20. Furthermore, large effect sizes were found for studies using student-generated GOs: d = 0.86 to 4.14. All reading comprehension assessments showing large effect sizes were researcher-developed comprehension tests (d = 0.81 to 1.69).

Table 2: Group-subject designs

Author Name/Date	Participants	Grade Level	Intervention Description	Research Design	Study Results
Ben-David (2002)	16 students with LD	7	Seventh-grade students with LD were given two months of instruction using GOs and linear note forms. An ANOVA was used to investigate the associations between relationships.	Quasi-experimental design	Means were calculated for four conditions: GO instruction with GO assessment (GO-GO), GO instruction with traditional text (GO-TT), linear notes instruction with GO assessment (LN-GO), and linear notes instruction with a traditional test (LN-TT). GO-GO: *M* = 78.8750, *SD* = 19.1155 GO-TT: *M* = 79.5625, *SD* = 13.2201 LN-GO: *M* = 85.7188, *SD* = 14.6381 LN-TT: *M* = 81.9063, *SD* = 17.4270 Linear notes appeared to be a more effective teaching method, with a combined mean of 83.8 than GO instruction, with a combined mean of 79.1. Statistical differences were calculated using an ANOVA. The mean difference between GO and LN was not significant (.05 on the alpha level of significance).
Dexter (2012)	62 students, of whom 19 had a reading LD, 36 were average achievers, and seven were low achievers	8	A pretest–posttest comparison group design was used to investigate the effects of a semantic mapping lesson plus visual display versus a semantic mapping lesson alone on the ability of adolescents with LD to gain and maintain factual knowledge from expository social studies material. In addition, a posttest-only comparison group design was used to examine the effects of a semantic mapping lesson plus visual display versus a semantic mapping lesson alone on the far-transfer ability of adolescents with LD.	Pretest-posttest comparison design Posttest-only comparison group design	Normally achieving students and low-achieving students experienced large gains from semantic mapping and visual display, while LD students showed significant improvement in maintenance and far-transfer ability. This finding was consistent over written and multiple-choice measures. Written Fact Recall: *ES* = .78, $p < .05$; mean gain increased from 2.67 to 4.00 in LD students; SM and visual display were favoured; LD students more able to recall factual details. Multiple-Choice Factual Recall: *ES* = .78, $p < .01$; mean gain increased from 6.21 to 7.61; mean post-test score = 14.85/20; equals 74.25% accuracy based on one class period of instruction.

					Far Transfer Ability: mean post-test score: *ES* = .53, $p < .05$; for students with LD: *ES* = 1.70; for normally achieving students: *ES* = .21; for low-achieving students *ES* = .91. SM + visual display: for students with LD: *ES* = 1.84, $p < .001$; for normally achieving students: *ES* = .47; for low-achieving students: *ES* = 2.96.
DiCecco and Gleason (2002)	24 students	6–8	Both the GO group and the control group received reading instruction and summary writing instruction over a one-month (20-session) treatment period.	Pretest-posttest control group design	The results supported the use of GOs to help students with LD in their recall of relational knowledge from expository textbooks. When factual knowledge was assessed via multiple-choice tests and quizzes, no differences were found between treatment and control conditions **Objective Measures:** On 20-item content knowledge multiple-choice test: the no-GO group improved from a mean of 4.25 (25%) to 12.58 (63%), while the GO group improved from a mean of 6.08 (30%) to 13.42 (67%). Content Knowledge Fact Quizzes: Participants in both conditions performed similarly. **Written Measures:** Relational Knowledge Statements Essays 1 & 2 (combined): No-GO: *M*= 2.54, *SD* = 1.56 GO: *M*=4.33, *SD* = 2.08 Frequency Counts (minimally different between two groups): Essay 1: No-GO = 34 statements GO = 47 statements Essay 2: No-GO = 27 statements, *M* = 2.25,*SD* = 1.96 GO = 57 statements, *M* = 4.75, *SD* = 1.42

Griffin, Simmons, and Kameenui (1991)	28 middle school students with LD (15 fifth, and 13 sixth-grade)	5–6	In contrast to the GO treatment group, the comparison group received the critical information from the text in a vertical list form. The GOs employed in this study were not designed to reflect the discourse structure of the reading; instead, they were hierarchically arranged to incorporate key vocabulary words and phrases extracted from the passage and to reflect the relationships of the individual units within the hierarchy. Both groups received four consecutive training sessions of 45 minutes each in their classrooms. The dependent measures were: researcher-developed oral free retell, researcher-developed production comprehension test, and researcher-developed multiple-choice comprehension test	Quasi-experimental design	The multivariate ANOVA results showed that there were no statistically significant differences between the average performance of students in the GO and NoGO conditions on either the immediate post-tests (F (4, 20) =.75, p> .05) or the delayed post-tests (F (2,24) = .79, p > .05). The results suggested that the GOs did not have a significant impact on the acquisition of science content.
Horton, Lovitt, and Bergerud (1990)	**Study 1 & 2:** 8 students with LD (5 middle school and 3 high school); 163 students without LD **Study 3:** 4 students with LD (3 middle school and 1 high school); 226 students without LD	Middle school and high school	The study compared teacher-directed GO instruction, student-directed instruction with text reference, and student-directed instruction with clues for students' self-study of the content material. 3 classes were selected: 2 to serve as the experimental group and 1 to serve as the neutral group. Duration/Intensity: two 45-minute sessions over 1 week.	True-experimental design	The results of three separate experiments indicated that the teacher-directed, student-directed with text references, and student-directed with clues conditions produced significantly higher performance than self-study for students with LD, remedial students, and students in regular education. The three experiments showed that students with LD averaged 70% correct with the use of GOs and 20% correct with self-study. Studies 1 & 2: p < .01; Study 3: p < .05

Ives (2007)	24 students with LD	6–12	Participants were divided into 2 groups: A: Students were taught to solve systems of linear equations through direct instructions. B. Students were taught with the same methods, but with the addition of a GO.	True-experimental design	Students who received instruction with the GOs outperformed those who received instruction without the GOs. They also better understood the related concepts, as measured by immediate posttests in both replications. Study 1: Prerequisite Skills: CO (control) group: *M* = 12.00, *SD* = 1.49 GO Group: *M* = 11.36, *SD* = 1.95 Teacher-generated tests: Mean score for the GO group was significantly higher than the mean score for the CO group. *ES* = Medium to large range. Investigator-generated tests: Concept section mean scores for the GO group were statistically significantly higher than mean scores for the CO group on concept sections of both the immediate posttests (*F* = 7.86, *p* = .009) and the follow-up posttests (*F* = 6.11, *p* = .020). Both *ES* = large. System-solving section: mean scores were not significantly different (*F* = 0.19, *p*= .664) from the follow-up or maintenance test (*F* = .00, *p* =1.0). Study 2: Language control: verbal instruction was comparable for both the GO and the CO groups. *ES* = medium to large range. An ANOVA test was used to compare mean scores across the two groups on each section of the investigator-generated test. System-solving section: mean scores were not significantly different (*F* = 1.09, *p* = .327). The alpha level was .10 (*F* = 11.26, *p* = 100).

Smith (2002)	10 students with LD	7	All subjects were exposed to GO and traditional methods of vocabulary instruction on a rotational weekly basis.	Quasi-experimental design	The findings showed no notable differences in vocabulary development between GO use and traditional methods. An ANOVA was performed. Means (M) were calculated for each of these conditions: Graphic Organizer Instruction; Traditional Assessment (M = 85.5, SD = 21.01). Traditional Instruction; Graphic Organizer Assessment (M = 83.40, SD = 18.36). Graphic Organizer Instruction; Graphic Organizer Assessment (M = 79.5, SD = 19.5) Traditional Instruction; Traditional Assessment (M = 93.15, SD = 12.49) The effects of instruction and test type were not statistically significant (F (3.76) = 1.9, p = .12).

The research on the effects of GOs on reading comprehension skills of middle-school students with LD is generally positive. That is, in many studies, the use of graphic organizers supported students' increased reading comprehension skills, particularly for adolescents with learning disabilities. In two large meta-analyses, teams of researchers have found that the use of GOs is associated with improved reading comprehension for students with LD (Kim et al., 2004; Dexter & Hughes, 2011). These findings are robust, with large effect sizes for students with LD in elementary, middle, and high schools (Kim et al., 2004), as well as in various content areas (Dexter & Hughes, 2011). Many of the other studies analyzed for this review also found positive effects of GOs on reading comprehension for middle-school students with LD. In the following sections, I describe these findings in greater detail.

GOs can support reading comprehension across content areas

Reading comprehension is often considered a key part of English/language arts instruction, but it is also vital for student learning across other content areas such as science, social studies, and mathematics. Ciullo and Reutebuch (2013) argue that this has become even more important since the implementation of the Common Core State Standards, which requires that students read expository text in all content areas. To support reading comprehension for all students, especially those with LD, educators in any content area can effectively use GOs as part of their instruction. The studies included in this review demonstrate the effectiveness of GOs in science (Dexter et al., 2011; Horton et al., 1990), social studies (DiCecco & Gleason, 2002; Horton et al., 1990), and mathematics (Ives, 2007) classrooms.

Middle-school science curricula often include complex texts that introduce new vocabulary, facts, and concepts to students. In their meta-analytic review Dexter and colleagues (2011) found that GOs can be useful tools for supporting vocabulary knowledge and reading

comprehension of complex texts, especially for students with LD. Their review suggests that student learning in these studies was deep, as students with LD showed improvement on assessments requiring higher-level cognitive skills like inference. Furthermore, students with LD maintained this knowledge over time. These findings are consistent with those of Horton and colleagues (1990), who found that students with LD performed significantly better on science assessments when they used GOs—both teacher-directed and student-directed—to learn the content.

Social studies classrooms also frequently involve complex texts, as students are expected to make sense of historical and political forces that may seem abstract or disconnected from their everyday lives. GOs can support students' reading comprehension and understanding of key concepts in social studies. Horton and colleagues (1990) and DiCecco and Gleason (2002) found that GOs can support students' relational knowledge, or their understanding of the connections between different ideas and actors. In these studies, students with LD in the experimental groups used GOs to record key concepts and ideas from expository texts; students in the control groups studied the same material, but without GOs. GOs supported students' understanding of social studies concepts, particularly on assessments that elicited description and explanation, rather than factual recall.

Even though mathematics is not often considered to be a domain requiring reading comprehension, understanding written texts is critical to student learning. Some mathematics texts clearly require reading knowledge (e.g., word problems), but interpreting mathematics symbols (e.g., equations) also requires a specialized form of reading comprehension. In his 2007 study, Ives used graphic organizers to support students' comprehension of systems of linear equations. He found that students with LD who used a GO to organize and represents the steps to

solving a system of linear equations developed deeper conceptual understanding of the process and were more successful on assessments.

Collectively, these studies demonstrate the versatility of GOs in supporting students' reading comprehension across content areas. Overall, students who used GOs performed significantly better than those who did not use GOs on assessments of their reading comprehension. And most importantly for the field of special education, these effects remained and were more pronounced, in many cases for students with LD than for their non-disabled peers.

Many different GOs support reading comprehension by showing relationships among ideas

Graphic organizers take on many different formats, including tree maps, concept maps, Venn diagrams, semantic organizers, and others (Sam & Rajan, 2013). Many different types of organizers can be used effectively in different settings. Indeed, the studies included in this review found positive effects on reading comprehension for students with LD using various types of GOs, including semantic mapping (Dexter, 2012), tables (Ives, 2007), and concept maps (DiCecco & Gleason, 2002; Horton et al., 1990). But the selection of GOs is not random. In each of these studies, the GOs that were selected highlighted key features of the content that students were expected to learn. DiCecco and Gleason (2002) hypothesize that this is a critical piece of what makes GOs effective. That is, GOs make high-level and abstract relationships more accessible for students. This is especially important in intermediate grades, where students are exposed to increasingly complex content. Also, it is especially beneficial for students with LD, who may face additional challenges in making sense of complex content as compared to their non-disabled peers.

One of the key ways that GOs support students' reading comprehension is by displaying

the relationships between different ideas, concepts, or actors. In middle-school social studies classrooms, DiCecco and Gleason (2002) used GOs that displayed the relationships between the key facts, themes, ideas, and actors in various units. In a similar style, Horton and colleagues (1990) used GOs that specifically showed the hierarchical relationships between different historical interest groups in a middle-school social studies classroom, and between different types of molecules and compounds in a middle-school science classroom. Both of these studies found that students with LD who used GOs as part of their instructional treatment had better reading comprehension than their LD peers who were taught the same content without GOs. This difference was particularly apparent when researchers elicited students' relational knowledge through essays, as opposed to assessing factual recall through multiple-choice questions (DiCecco & Gleason, 2002). This suggests that GOs can be designed to highlight the relationships among different concepts within a content area, and that the GOs can support reading comprehension by making these conceptual relationships clearer for students.

There is further evidence that graphic organizers that include visual elements may be especially effective for supporting reading comprehension for students with LD. For instance, Dexter (2012) examined students' reading comprehension based on expository text in a social studies classroom. He found that semantic mapping (SM) with a visual display was more effective than SM without a visual display, especially for supporting students' long-term understanding and far transfer of knowledge. Furthermore, this effect was significant for students of various abilities, but the effect was particularly pronounced for students with LD. This suggests that including a visual representation of the concepts being presented in the GO can further support students' reading comprehension.

Students need explicit instruction and practice to use GOs effectively

Even though much of the research on reading comprehension for students with LD shows the effectiveness of GOs, there are some studies that highlight the importance of key implementation considerations. GOs are most effective when students have explicit instruction in how to use them, as well as experience and practice with using them (Ciullo & Reutebuch, 2013; Griffin et al, 1991).

GOs can be a powerful tool for making sense of complex material. Yet students must understand what GOs illustrate and what relationships they show—that is, they must learn how to use the tool in order for it to be effective. In their systematic literature review, Ciullo and Reutebuch (2013) examined the use of computer-based GOs for students with LD. They consistently found that studies that did not explicit instruction in the use of GOs were ineffective in supporting student learning on any measure, including reading comprehension. On the other hand, studies that included explicit instruction on using GOs were effective at supporting students' reading comprehension. This finding relates to the positive effects from the studies described above, in which the strongest effects were found when teachers provided direct instruction for students with LD on how to use GOs (e.g., Horton et al., 1990; Dexter et al., 2011).

There is further evidence that students with LD benefit from having gaining practice and experience with GOs. The studies that found positive effects of GOs typically included longer interventions. Students in DiCecco and Gleason's (2002) study, for instance, received instruction with GOs for 20 consecutive school days, during which they developed at least five different GOs. This extended experience with GOs supported students' familiarity and facility in the GOs and what they represent. In contrast, Griffin and colleagues (1991) worked with students for four 45-mintute periods, and the description of their instructional method suggests little explanation

of the purpose and structure of the GOs they used. Providing students with sufficient time to understand how GOs work and what they represent may be a key element of effective implementation of GOs.

Finally, it may be important that students have consistent experience in using GOs to make sense of complex texts. Ben-David (2002) and Smith (2002) both examined the effectiveness of GOs by alternating instructional methods each week for eight weeks. They alternated between teaching with GOs and linear notes. At the end of each week, they assessed students' reading comprehension and vocabulary development, respectively. In their respective studies, they each found that GOs were not statistically significantly more effective than linear notes at supporting student learning, regardless of the type of assessment used. Though there are a number of limitations of their studies (including very small sample sizes, which obscure all but the largest effects), it may be that alternating between GOs and linear notes may be less effective than regularly incorporating GOs into regular instruction.

CHAPTER 4

DISCUSSION

This systematic review identified relevant research on the effects of using GOs with students with LD to improve their reading comprehension and their ability to understand academic content. This systematic review focused on the efficacy of GOs in middle schools. I sought out studies published after 1990 that specifically focused on English-speaking students in grades 6 through 8 who had been identified as having LD. Each of these studies examined the relationship between students' reading comprehension or their ability to understand targeted information and their use of GOs. I reviewed 11 studies that met the inclusion criteria, including one systematic review, three meta-analyses, and nine studies with experimental designs (including pretest–posttest comparison designs, quasi-experimental designs, true-experimental designs, matched-subjects designs, and pretest–posttest control group design; see Tables 1 and 2).

The guiding research question for this systematic review was: What is the effect of GO use on the reading comprehension skills of middle school students identified as having LD? Overall, the review demonstrates that GOs can be effective tools for supporting reading comprehension, particularly for students with LD. A major theme across the reviewed studies is the versatility of GOs in supporting student learning. GOs can help students understand, organize, and represent complex concepts (Dexter & Hughes, 2011; Scruggs et al., 2008). They are especially effective for helping students make sense of complex texts (Gajria et al., 2004). Furthermore, using GOs can help students develop stronger critical thinking skills and higher-level thinking skills (Cleveland, 2005), such as connecting to prior knowledge and making inferences (Kim et al., 2004). Several studies found that GOs support student success as

measured by assessments, especially researcher-developed reading tests (Cleveland, 2005; Dexter & Hughes, 2011; Kim et al., 2004). Even though many of studies found these effects for all groups of participating students, the effects were typically strongest for students with LD.

Notably, this collection of studies shows the wide range of content areas in which GOs can be used to support students' comprehension, particularly for students with LD. GOs can be used effectively in nearly every discipline, including reading, science, and social studies (Dexter & Hughes, 2011; Horton et al., 1990; Ives, 2007). Furthermore, students with disabilities can benefit from using GOs in inclusive classroom settings, in small groups, or on their own (DiCecco & Greason, 2002; Horton et al., 1990). Thus, there is ample evidence to support the notion that students' use of GOs can facilitate their reading comprehension and ability to understand academic information across content areas and classroom settings.

Nevertheless, a smaller number of studies showed some of the limitations of GOs. For instance, Griffin and colleagues (1991) found that GOs were no more effective than traditional instruction for supporting students' recall of key information in the weeks following instruction. Similarly, Smith (2002) and Ben-David (2002) found that GOs were no more effective than traditional instruction in supporting reading comprehension for middle-school students with LD. Though these studies contradict the findings of other research, it is notable that they have important limitations that may have affected their outcomes. Griffin and colleagues (1991) used a shorter treatment period than other studies that found more significant results; it is likely that students with LD need experience and practice with GOs for them to be effective. Furthermore, Smith (2002) and Ben-David (2002) used statistical analyses with very small numbers of participants, which likely limited the power of studies. Importantly, there is no evidence that

using GOs hurts reading comprehension for middle-school students with LD; these studies simply found that GOs were no more effective than other forms of instruction.

Implications for Practice

The preponderance of evidence reviewed in this analysis suggests that GOs are promising tools for supporting reading comprehension for middle-school students with LD. Teachers who seek to support reading comprehension for students with LD should consider incorporating GOs into their instructional practice. The literature also sheds light on important implications for teachers' work with GOs. Since GOs are versatile and come in many different forms, it is important for teachers to be thoughtful about incorporating GOs into individual, small-group, and whole-group instruction with middle school students with LD.

A key implication for practice is that teachers should select GOs that intentionally highlight the relationships across focal content knowledge. DiCecco and Gleason (2000) hypothesize that part of the power of GOs is that they make relational knowledge clearer for students with LD. This increases students' reading comprehension because they have a structure to organize and visualize the content of expository texts. Many of the studies in this review used GOs to intentionally highlight important relationships. Ives (2007), for instance, used a table to organize and clarify the steps in solving a system of equations, while Horton and colleagues (1990) used concept maps that emphasized the hierarchical relationships among concepts in social studies and science units. Selecting a GO that matches the academic goals of a lesson is an important part of the design of these studies. In a similar vein, teachers should select GOs that match the focal content of instruction.

In addition to selecting appropriate GOs, teachers should instruct students with LD in how to use GOs to aid in their reading comprehension. In studies that demonstrated the

effectiveness of GOs in supporting reading comprehension for students with LD, participating teachers explicitly instructed students on how to use GOs and provided them with opportunities to practice using them (e.g., DiCecco & Gleason, 2000, Ciullo & Reutebuch, 2013; Dexter, 2012). This was also a key feature of Horton et al.'s (1990) study, which found that middle school students with LD who used GOs with teachers' guidance experienced much greater improvement than those who used GOs on their own. Ciullo and Reutebuch (2013) similarly found that computer-based GOs are only effective when students with LD receive direct instruction in how to create and use the GOs. Some GOs have labels for different sections or arrows to identify key relationships. Thus, teaching students what different labels and arrows mean can help them understand what a particular GO is demonstrating. A teacher may first demonstrate how to fill in the sections of a GO, and then have students attempt it on their own. By explicitly teaching students how to use GOs, teachers can help students make sense of and utilize GOs as effective learning tools.

Nonetheless, teachers must be mindful that GOs are not all equivalent. Due to the variety of types and uses of GOs, it is important that teachers introduce each GO separately (Gallavan & Kottler, 2007). Across the studies in this literature review, teachers and researchers used various GOs, including flow charts, concept maps, semantic maps, Venn diagrams, and more. Each of these GOs displays information in different ways and fosters students' use of different cognitive and metacognitive processes. Students' familiarity with one GO will not necessarily transfer to their use of another GO. Thus, an important caveat to the previous implication is that teachers should instruct students in using different types of GOs.

CHAPTER 5

CONCLUSION

Overall, graphic organizers are effective tools for supporting reading comprehension, particularly for middle-school students with learning disabilities. GOs can help clarify the relationships between concepts, facts, ideas, and actors in across content areas. This makes complex expository texts more accessible for students. Though GOs can support learning for all students, they are especially useful for students with LD, as they may need additional support to make sense of the connections across abstract ideas. When implemented well, GOs are very powerful for supporting their success, including their long-term understanding of important content.

As researchers continue to study the use of GOs with middle-school students with LD, the field would benefit from a deeper understanding of effective implementation of GOs. The quantitative studies reviewed in this analysis demonstrate the potential for GOs to support reading comprehension for groups of students. But there is a lack of research on the details of the implementation process: How do educators introduce GOs and leverage them effectively? What are the different ways that students make sense of GOs? There also may be particular considerations for using GOs with students who have different types of learning disabilities or who come from different socioeconomic backgrounds. Studies that investigate these issues can enrich our collective understanding of GOs in special education.

Limitations

This review is subject to limitations commonly linked with systematic reviews, including a failure to capture all existing studies. Only a small number of studies met the inclusion criteria (n = 12). The use of certain keywords or search terms and inclusion criteria may have resulted in

the exclusion of related literature significant to this analysis. Unintentionally omitted studies may provide additional information about GOs, including greater evidence that GOs are not always effective.

This review is also limited by the details included within each article. As in any academic research, there are important details of the study that are not included in the published journal article. Many of the studies reviewed in this analysis failed to include details like the types of GOs and assessments used, the instructional setting (e.g., individual, small-group, or whole-group instruction), and even the length of the intervention itself. Furthermore, very few studies provided details on the demographic and academic backgrounds of the participants, their schools, and their communities. These omissions make it difficult for other teachers to implement GOs in their own classrooms in similar ways. They may also unintentionally obscure important differences among different groups of students, their teachers, and their schools.

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Major Professor: Dr. Dimitris Anastasiou