Graphic Organizers:
A Review of Scientifically Based Research

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Prepared for Inspiration Software®, Inc. by
The Institute for the Advancement of Research in Education (IARE) at AEL
EXECUTIVE SUMMARY

Kidspiration® and Inspiration® are used widely in schools across the country to accomplish curriculum goals using visual learning as implemented by the use of graphic organizers such as concept maps, idea maps, and webs.

Prepared by Institute for the Advancement of Research in Education. To provide educators with evidence of the instructional effectiveness of the use of graphic organizers, Inspiration Software®, Inc. contracted with the Institute for the Advancement of Research in Education (IARE) at AEL to conduct a study of existing educational research. IARE is an independent research body that provides research and evaluation services to clients in the education arena. IARE draws on the expertise and credibility of its 36-year-old parent company, AEL, to deliver unbiased, customized services grounded in accepted research and evaluation standards.

Identification of 29 scientifically based research studies. IARE staff conducted an extensive search of academic databases to locate research on the instructional effectiveness of the use of graphic organizers. Using the definitions set forth by Section 9101 of the No Child Left Behind Act (NCLB) of 2001, IARE selected 29 scientifically based research studies that applied rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs.

Visual learning strategies improve student performance. Scientifically based research cited in the literature review demonstrates that a research base exists to support the use of graphic organizers for improving student learning and performance across grade levels, with diverse students, and in a broad range of content areas. IARE conclusions from this review include:

- **Reading comprehension.** Use of graphic organizers is effective in improving students’ reading comprehension.
- **Student achievement.** Students using graphic organizers show achievement benefits across content areas and grade levels. Achievement benefits are also seen with students with learning disabilities.
- **Thinking and learning skills.** The process of developing and using a graphic organizer enhances skills such as developing and organizing ideas, seeing relationships, and categorizing concepts.
- **Retention.** Use of graphic organizers aids students in retention and recall of information.
- **Cognitive learning theory.** The use of graphic organizers supports implementation of cognitive learning theories: dual coding theory, schema theory, and cognitive load theory.
SUMMARY

Inspiration Software, Inc. contracted with the Institute for the Advancement of Research in Education (IARE) at AEL to review the theoretical and/or research bases of visual learning and the use of graphic organizers for instruction.

Inspiration Software, Inc. offers premier software tools (Inspiration and Kidspiration) for use in K-12 schools. Inspiration, designed for students in grade six to adult, can be used across the curriculum for brainstorming, webbing, diagramming, planning, concept mapping, organizing, and outlining. Kidspiration, for students in kindergarten through grade five, helps students brainstorm ideas with pictures and words, organize and categorize information visually, and create stories and descriptions. Both offer an integrated graphic organizer tool and outline tool that work together to help students comprehend concepts and information (http://www.inspiration.com/productinfo).

IARE reviewed the theoretical and/or research bases of graphic organizers and visual learning to inform Inspiration Software, Inc. of what scientifically based research (SBR) indicates about the effects of these visual tools on student achievement, critical thinking, reading comprehension, and writing. Inspiration Software, Inc. identified these areas as being key to its assessment of its products’ potential effectiveness.

To meet this purpose, four major areas of literature were reviewed:

1. Learning theories that support the use of graphic organizers. These learning theories include the dual coding theory, schema theory, and cognitive load theory.
2. The benefits of graphic organizers on student achievement in terms of literacy development. Inspiration Software, Inc. further defined literacy development as vocabulary development, early reading comprehension (kindergarten through second grade), reading in other grades (3-12), and writing skills.
3. The use of graphic organizers for thinking and learning skills. Inspiration Software, Inc. defined thinking and learning skills to include critical thinking, retention, problem solving, and note taking or outlining.
4. The use of graphic organizers in other classroom work. In particular, curriculum, grade, and student-population-specific uses were examined.
Methodology

Research in each of the four major areas of the paper (learning theories, graphic organizers for literacy development, graphic organizers for thinking and learning skills, and graphic organizers in other classroom work) was identified. Using academic databases such as ERIC, IARE conducted key word searches to locate research on graphic organizers and the theories supporting their use. Studies and research referenced in reports such as the National Reading Panel’s 2000 report titled Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction and the National Center on Accessing the General Curriculum’s report providing evidence on the effectiveness of concept maps were obtained (http://www.cast.org/ncac/ConceptMaps1669.cfm). Research referenced from other research-based sources, such as Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement (Marzano et al., 2001), were also retrieved. A final source was a bibliography provided by Inspiration Software, Inc. Prior to contracting with IARE to complete this review, Inspiration Software, Inc. looked at some of the research and theories that lend support to the use of graphic organizers. The company’s white paper provided an overview of the theoretical background and studies supporting the use of graphic organizers in K-12 classrooms.

Research studies selected for inclusion in this review were limited to those meeting criteria for SBR as defined by Section 9101 of the No Child Left Behind Act (NCLB) of 2001. Briefly, such research involves the application of rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs. IARE staff reviewed the research and, using the criteria from NCLB and the National Research Council’s volume Scientific Research in Education (Committee on Scientific Principles for Education Research, 2002), selected only studies that aligned with these criteria to include in this review. NCLB’s definition of SBR draws particular attention to experimental and quasi-experimental designs. Both experimental and quasi-experimental designs employ experimental and comparison groups. An experimental group is a group, in a research study, that receives the treatment or intervention. While experimental or quasi-experimental designs must include at least one comparison group, they may or may not include a control group (Redfield, Sivin-Kachala, & Schneiderman, 2003).

The main difference between experiments and quasi-experiments is that in experiments, study participants are randomly selected from the population to which results of the study are to be generalized and/or randomly assigned to experimental and comparison groups, but not necessarily to both. Random selection is not haphazard or arbitrary. It follows a specified procedure using a Table of Random Numbers or a computer program for random selection. A sample either is random or it is not (Redfield, Sivin-Kachala, & Schneiderman, 2003).
Summary of Findings

Research cited in this literature review shows that a research base exists to support the use of graphic organizers for improving student learning and performance across grade levels, with diverse students, and in a broad range of content areas. The products from Inspiration Software, Inc. appear to be supported by the findings from SBR. A total of 29 SBR studies were reviewed in this paper. Of these, eight studies cut across two of the paper’s major areas, meaning that examples from these studies were used in more than one area (e.g., SBR on the use of graphic organizers for thinking and learning skills, and SBR on the use of graphic organizers for literacy development).

Specific findings of the research follow. These findings are organized around the four major areas of research reviewed.

Cognitive Learning Theories

- Dual coding theory maintains that we code information both in verbal and nonverbal formats. By attending to both formats (e.g., nonverbal as well as verbal can be addressed through the use of graphic organizers), information is easier to retain and recall.

- Schema theory explains that within our memory exists schemas, or networks of information. The use of a graphic organizer can help students link the existing knowledge organized in schemas to the new knowledge.

- Cognitive load theory suggests that working memory has a maximum capacity of information it can process. If that load is exceeded, learning does not take place. Graphic organizers, if used appropriately, can help reduce the cognitive load and, consequently, enable more resources (working memory) to be devoted to learning new material.

SBR on the Use of Graphic Organizers for Literacy Development

- One SBR study (Brookbank et al., 1999) and a meta-analysis of 23 studies (Moore & Readence, 1984) concluded that graphic organizers moderately affect vocabulary test scores. The SBR study (quasi-experimental), which involved two classes of first- and second-grade students, found that graphic organizers helped at least 80% of students at all grade levels master key vocabulary skills.

- Two quasi-experimental SBR studies (Gallick-Jackson, 1997; Meyer, 1995) focused on the use of graphic organizers as a part of the writing process for second- and third-grade students. Results of posttests and writing samples revealed that students’ writing skills improved.

- Two quasi-experimental SBR studies (Brookbank et al., 1999; Sinatra et al., 1984) that included early elementary age students (first and second grade) found that graphic organizers helped improve students’ reading comprehension.
• Following a review of the research literature on vocabulary and text comprehension instruction, the National Reading Panel (2000) cited graphic and semantic organizers (including story maps) as one of seven categories of instruction that are the most effective in the improvement of reading comprehension. Findings from the seven SBR studies (Berkowitz, 1986; Bowman et al., 1998; Darch et al., 1986; Davis, 1994; Gordon & Rennie, 1987; Reutzel, 1985; Troyer, 1994) (four quasi-experimental, three experimental) included in this paper concurred with these findings.

SBR on the Use of Graphic Organizers for Thinking and Learning Skills

• Two SBR studies (Brookbank et al., 1999; DeWispelaere & Kossack, 1996) examined how critical thinking skills or higher order thinking skills were enhanced as a result of using graphic organizers. The quasi-experimental studies involved students from six elementary, junior high, and high school classrooms. Findings indicated that graphic organizers enable students to improve critical thinking and higher order thinking skills, as measured by teacher observations and student performance on classroom projects.

• Three SBR studies (Bos & Anders, 1992; Ritchie & Volkl, 2000; Griffin et al., 1995) examined the effects of graphic organizers on retention and recall. Overall findings of the three studies (two quasi-experimental, one experimental) indicated that graphic organizers are a helpful method for improving student retention and recall of information for both elementary and junior high students with learning disabilities, as well as upper elementary students (fifth and sixth grade). Follow-up tests at various intervals following instruction found that students retained information they learned via graphic organizers. In one study, graphic organizers were also found to help students transfer retention and recall skills to new situations (Griffin et al., 1995).

• Findings from one quasi-experimental SBR study that used graphic organizers as a problem-solving tool in mathematics demonstrated that fifth-grade students’ problem-solving skills improved based on teacher observation (Braselton & Decker, 1994).

• Two quasi-experimental SBR studies (Doyle, 1999; Meyer, 1995) used graphic organizers as an outlining tool. One study used graphic organizers with eight senior high students with learning disabilities in the area of social studies. The second study, which integrated graphic organizers as a part of the creative writing process, was conducted with a class of third-grade students. The first study concluded that graphic organizers were a viable alternative to conventional note taking methods, as measured by results on the end-of-chapter test. Graphic organizers also assisted students in the writing process, as measured by writing samples.
SBR on the Use of Graphic Organizers in Other Classroom Work

The majority of SBR studies included in this review have used graphic organizers with students in the upper elementary (fourth and fifth) and middle level (sixth, seventh, and eighth) grades (24 studies). A smaller number of studies have taken place in the lower elementary grades (four studies) and with secondary school students (four studies). (Note: Some studies included more than one grade level; consequently, the total across the three levels adds up to more than 29 SBR studies.) Findings from the studies included in this review show that the effects of using graphic organizers are positive. In other words, students have demonstrated improvement in achievement or performance in the content assessed. Findings from the studies suggest that graphic organizers are an advantageous teaching and learning strategy at the upper elementary and middle level grades.

• Five SBR studies (Guastello et al., 2000; Hawk, 1986; Ritchie & Volkl, 2000; Simmons et al., 1988; Willerman & Mac Harg, 1991) focused on the use of graphic organizers to facilitate middle level students’ (sixth, seventh, and eighth grade) learning of science content. Findings from these studies (three quasi-experimental, two experimental) indicate that the graphic organizer is an effective tool for aiding student comprehension and retention of science material. Additionally, students using concept maps scored higher on posttests than students receiving more traditional types of instruction.

• Four SBR studies (Alvermann & Boothby, 1983; Alvermann & Boothby, 1986; Armbruster et al., 1991; Griffin et al., 1995) in the area of social studies used graphic organizers to help students organize information from expository texts and comprehend content area reading. All four studies were conducted with either fourth- or fifth-grade students. Findings from the four studies (two quasi-experimental, two experimental) found that graphic organizers helped students select, organize, and recall relevant information, as measured by posttests. Students were also able to transfer thinking and learning skills to novel situations and content.

• One quasi-experimental SBR study (Braselton & Decker, 1994) with sixth-grade mathematics students found graphic organizers to be advantageous in the improvement of students’ problem-solving skills.

• One quasi-experimental SBR study (DeWispelaere & Kossack, 1996) in a junior high and high school Spanish as a second language class found that graphic organizers improved students’ higher order thinking skills as measured by performance on chapter quizzes, tests, and student projects.

• The seven SBR studies (Boyle & Weishaar, 1997; Doyle, 1999; Gallego et al., 1989; Gardill & Jitendra, 1999; Griffin et al., 1991; Scanlon et al., 1992; Sinatra et al., 1984) on the use of graphic organizers with students with learning disabilities included in this review indicated that graphic organizers are beneficial with this population of students. The studies (five quasi-experimental, two
experimental) found the use of graphic organizers to be an effective strategy in helping students comprehend content area material, organize information, and retain and recall content, as measured by posttests. Graphic organizers have also been found to be effective tools for helping students organize information and make connections with existing schemas.

Conclusions

The primary purpose of this literature review was to analyze the extant research on visual learning and graphic organizers to determine what the findings from SBR indicated about the effects these visual tools had on student achievement, critical thinking, comprehension, and writing. Inspiration Software, Inc. identified these areas as key to the assessment of its products’ effectiveness. The conclusions in this section are drawn to align with this purpose. After reviewing 29 SBR studies, researchers drew several conclusions about the effects of graphic organizers on student achievement, critical thinking (and thinking and learning skills as a whole), and reading comprehension and writing (literacy development).

Student Achievement

The benefits of graphic organizers across several content areas (science, social studies, mathematics, Spanish as a second language, vocabulary, reading, and writing), multiple grade levels (first through senior high school), and different student populations (regular education students and students with learning disabilities) have been verified in the 29 experimental and quasi-experimental SBR studies cited throughout this paper. All of the studies included in this review have shown that using graphic organizers led to improved student performance as measured by various forms of assessments (classroom-based, observation, textbook, and standardized). Graphic organizers also have been found to result in superior student performance when compared with more traditional forms of instruction (e.g., lecture, linear note taking, question/answering).

SBR supports the use of graphic organizers at the upper elementary and middle level grades (sixth through eighth) (Alvermann & Boothby, 1986; Alvermann & Boothby, 1983; Armbruster et al., 1991; Berkowitz, 1986; Braselton & Decker, 1994; Brookbank et al., 1999; Bowman et al., 1998; Darch et al. 1986; Davis, 1994; DeWispelaere & Kossack, 1996; Gallego et al., 1989; Gardill & Jitendra, 1999; Gordon & Rennie, 1987; Griffin et al., 1995; Griffin et al., 1992; Guastello et al., 2000; Hawk, 1986; Reutzel, 1985; Ritchie & Volkl, 2000; Scanlon et al., 1992; Simmons et al., 1988; Sinatra et al., 1984; Troyer, 1994; Willerman & Mac Harg, 1991).

Some SBR (Brookbank et al., 1999; Davis, 1994; Gallick-Jackson, 1997; Meyer, 1995; Sinatra et al., 1984) also exists to support the use of graphic organizers in the lower elementary grades (kindergarten through third). Positive results have been shown with secondary grade level (ninth through twelfth) students as well (Boyle & Weishaar, 1997; DeWispelaere & Kossack, 1996; Doyle, 1999; Scanlon et al., 1992).
For the special population of students with learning disabilities, graphic organizers have been used with success (Boyle & Weishaar, 1997; Doyle, 1999; Gallego et al., 1989; Gardill & Jitendra, 1999; Griffin et al., 1992; Scanlon et al., 1992; Sinatra et al., 1984). Students with learning disabilities typically have difficulty comprehending content area texts and lack reading comprehension skills (Scanlon et al., 1992). Graphic organizers have been found to be effective tools for helping these students organize information and make connections with existing schemas. As a result, for the students with learning disabilities studied, comprehension and recall of information was enhanced.

**Critical Thinking**

The process of developing and using a graphic organizer has been shown to enhance students’ critical thinking or higher order thinking skills (Brookbank et al., 1999; DeWispelaere & Kossack, 1996).

In addition to developing critical thinking skills, graphic organizers have also been shown to help students with mathematical problem solving (Braselton & Decker, 1994). Graphic organizers have helped students retain and recall information (Bos & Anders, 1992; Ritchie & Volkl, 2000; Griffin et al., 1995). And, students have effectively used graphic organizers as an outlining tool (Doyle, 1999; Meyer, 1995). Doyle (1999) found students with learning disabilities obtained higher test scores on end of chapter tests if they used graphic organizers as study tools as compared to traditional linear note taking methods. Meyer (1995) concluded third grade students’ writing improved as a result of using graphic organizers to organize ideas.

As a tool to support students’ thinking and learning processes, the 29 research studies have shown that graphic organizers help students:

- brainstorm ideas.
- develop, organize, and communicate ideas.
- see connections, patterns, and relationships.
- assess and share prior knowledge.
- develop vocabulary.
- outline for writing process activities.
- highlight important ideas.
- classify or categorize concepts, ideas, and information.
- comprehend the events in a story or book.
- improve social interaction between students, and facilitate group work and collaboration among peers.
- guide review and study.
- improve reading comprehension skills and strategies.
- facilitate recall and retention.
Reading Comprehension and Writing (Literacy Development)

Graphic organizers have been found to improve students’ reading comprehension at all levels, first grade through high school (Berkowitz, 1986; Bowman et al., 1998; Brookbank et al., 1999; Davis, 1994; Darch et al., 1986; Gordon & Rennie, 1987; Reutzel, 1985; Sinatra et al., 1984; Troyer, 1994); in content area classes, for example, science and social studies (Alvermann & Boothby, 1986; Griffin et al., 1995; Guastello et al., 2000); and with students with learning disabilities (Gardill and Jitendra, 1999). A limited amount of research has been conducted with students at the early elementary level—first and second grade (Brookbank et al., 1999; Sinatra et al., 1984).

Further support for graphic organizers was found in a report by the National Reading Panel (2000) titled *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction.* NRP cited graphic and semantic organizers (including story maps) as one of seven categories of instruction that is the most effective in improving reading comprehension.

Evidence has also been found to indicate graphic organizers benefit elementary age students (second and third grade) in the writing process and improve their writing skills (Gallick-Jackson, 1997; Meyer, 1995).
INTRODUCTION

Inspiration Software, Inc. contracted with the Institute for the Advancement of Research in Education (IARE) at AEL to review the theoretical and/or research bases of visual learning and the use of graphic organizers for instruction.

Graphic organizers—visual displays that make information easier to understand and learn (Dye, 2000)—are a popular strategy in schools. Graphic organizer is the umbrella term for the various types of visual organizers. The National Center on Accessing the General Curriculum (NCAC) defines a graphic organizer as “a visual and graphic display that depicts the relationships between facts, terms, and/or ideas within a learning task” (http://www.cast.org/ncac). Graphic organizers are sometimes referred to as concept maps, story maps, advance diagrams, semantic maps, or concept diagrams.

Hyerle (1996) classifies visual tools into three categories that correspond to the three purposes of the tools: brainstorming webs, task-specific organizers, and thinking process maps. Within each of these categories are specific types of graphic organizers. Brainstorming webs include mind mapping, webbing, and clustering. Task-specific organizers include life cycles (used in science), text structures (used in reading), and decision trees (used in mathematics). Thinking process maps include concept maps, diagrams for systems thinking, and thinking maps. For purposes of this review, graphic organizers are defined as all of the types listed above.

Inspiration Software, Inc. Product Information

Inspiration Software, Inc. offers premier software tools (Inspiration and Kidspiration) for use in K-12 schools. Inspiration, designed for students in grade six to adult, can be used across the curriculum for brainstorming, webbing, diagramming, planning, concept mapping, organizing, and outlining. Kidspiration, for students in kindergarten through grade five, helps students brainstorm ideas with pictures and words, organize and categorize information visually, and create stories and descriptions. Both offer an integrated graphic organizer tool and outline tool that work together to help students comprehend concepts and information (http://www.inspiration.com/productinfo).

Literature Review Purpose

IARE reviewed the theoretical and/or research bases of visual learning and the use of graphic organizers to provide Inspiration Software, Inc. with an understanding of what SBR indicated about the effects of these tools on student achievement, critical thinking, comprehension, and writing. Inspiration Software, Inc. had indicated that understanding the effects of these tools in these four areas was key to its assessment of its products’ effectiveness.
To accomplish this purposes, four major areas of literature were reviewed:

1. Learning theories that support the use of graphic organizers were examined. These learning theories include the dual coding theory, schema theory, and cognitive load theory.
2. The benefits of graphic organizers on student achievement in terms of literacy development. Inspiration Software, Inc. further defined literacy development as vocabulary development, early reading comprehension (kindergarten through second grade), reading in other grades (3-12), and writing skills.
3. The use of graphic organizers for thinking and learning skills. Inspiration Software, Inc. defined thinking and learning skills to include critical thinking, retention, problem solving, and note taking or outlining.
4. The use of graphic organizers in other classroom work. In particular, curriculum, grade, and student-population-specific uses were examined.

**Methodology**

Using academic databases such as ERIC, IARE conducted keyword searches to locate research on the use of graphic organizers and the theories supporting graphic organizers. Research in each of the four major areas (learning theories, graphic organizers for literacy development, graphic organizers for thinking and learning skills, and graphic organizers in other classroom work) was identified. Studies and research referenced in reports were obtained. These included, among others, the National Reading Panel’s 2000 report *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction* and the National Center on Accessing the General Curriculum’s report, which provides evidence on the effectiveness of concept maps (http://www.cast.org/ncac/ConceptMaps1669.cfm).

Research referenced from other research-based sources, such as *Classroom Instruction that Works: Research-Based Strategies for Increasing Student Achievement* (Marzano et al., 2001), was also retrieved. A final source for obtaining additional references was a bibliography provided by Inspiration Software, Inc.

Prior to contracting with IARE to complete a comprehensive review of SBR, Inspiration Software, Inc. looked at some of the research and theories that lend support to the use of graphic organizers. The company’s white paper provided an overview of the theoretical background and studies supporting the use of graphic organizers in K-12 classrooms.

The research in this review on the use of graphic organizers in the classroom and their effects on student achievement, critical thinking, comprehension, and writing skills was limited to that defined as SBR. The first part of the paper, however, overviews several theories that have implications for graphic organizers; hence, this section is descriptive in nature and not SBR.

The research community has developed a variety of definitions, standards, and criteria for ensuring that research is of the highest rigor and quality. Using the definitions set forth by Section 9101 of the *No Child Left Behind Act (NCLB)* of 2001, IARE selected research
that applied rigorous, systematic, and objective procedures to obtain reliable and valid knowledge relevant to education activities and programs. More specifically, the research (1) employed systematic, empirical methods; (2) involved rigorous data analyses; (3) relied on methods or measurements that provided reliable and valid data; (4) was evaluated using experimental or quasi-experimental designs; (5) ensured that experimental studies were presented in sufficient detail and clarity to allow for replication; and (6) was accepted by a peer-reviewed journal.

NCLB’s definition of SBR draws particular attention to experimental and quasi-experimental designs. Both experimental and quasi-experimental designs employ experimental and comparison groups. An experimental group is a group, in a research study, that receives the treatment or intervention. While experimental or quasi-experimental designs must include at least one comparison group, they may or may not include a control group (Redfield, Sivin-Kachala, & Schneiderman, 2003).

The main difference between experiments and quasi-experiments is that in experiments, study participants are randomly selected from the population to which results of the study are to be generalized and/or randomly assigned to experimental and comparison groups, but not necessarily to both. Random selection is not haphazard or arbitrary. It follows a specified procedure using a Table of Random Numbers or a computer program for random selection. A sample either is random or it is not (Redfield, Sivin-Kachala, & Schneiderman, 2003).

The research selected also met the principles outlined by the National Research Council (NRC) in its volume titled *Scientific Research in Education* (Committee on Scientific Principles for Education Research, 2002). According to the NRC, scientific research:

- poses significant questions.
- links to relevant theory.
- uses tools valid for addressing the research questions.
- rules out counter explanations.
- produces replicable findings.
- survives the scrutiny of colleagues and publics.

Underlying these traits is the principle that scientific research is designed to (1) document the extent to which claims are valid and (2) rule out as many alternative explanations as possible.

Each of the research studies obtained was examined to determine whether it measured up to these principles. One NCLB and NRC standard that was particularly difficult to gauge across all studies, due to the limited amount of information provided, was the extent to which measures were valid and reliable. Many of the studies used classroom assessments as the measure of effectiveness. Classroom assessments can vary from teacher to teacher and, moreover, do not have the same psychometric properties as standardized measures. Also troublesome was NCLB’s criteria that SBR studies appear in peer-reviewed journals. All research studies included in this review were from reputable education journals or were master’s students’ projects. However, a determination was not made as
to whether the journals were peer-reviewed. All of the studies met the sixth NRC hallmark of scientific research, surviving the scrutiny of colleagues and publics.

After all of the studies were reviewed, the selected SBR studies were then classified according to several key characteristics: type of information provided (e.g., theoretical or classroom practice), curriculum uses, grade level, student population, evidence provided supporting thinking and learning skills, and evidence provided on supporting and improving literacy development. These classifications serve as the organizational scheme for presenting the findings of the literature review.

**Limitations of Review and Research**

None of the studies reviewed used computer software such as the products from Inspiration Software, Inc. for the development or incorporation of graphic organizers in teaching and learning. However, the ways in which graphic organizers are used in these studies are the type of processes and outcomes that can be accomplished with products from Inspiration Software, Inc. It is surmised that the use of software may even enhance the process as it can reduce limitations imposed by drawing and handwriting.

The review of literature reported in this document was limited to assessing whether or not graphic organizers had a positive effect on learning. Within each of the studies, there was a wide variance in methodologies—for example, when the graphic organizer was used (pre- or postinstruction), teacher- versus student-created graphic organizer, type of assessment measure used, timing of assessment (immediate versus delayed testing), or instruction in the use of graphic organizers. Because the goal of the literature review was to examine the overall effectiveness of graphic organizers as a strategy and tool for student learning, the differences in each study’s procedures were not taken into account, except to determine if the study had a quasi-experimental or experimental design.
FINDINGS

The findings section is organized around the four major areas of literature reviewed.

Cognitive Learning Theories

To understand what makes graphic organizers an effective learning tool, it is helpful to have some knowledge of the various theories of brain function and learning. Knowledge gained over the past 30 years about how the brain processes information has been instrumental in the development of teaching techniques and learning strategies.

Several cognitive theories of learning particularly lend support to the use of graphic organizers in helping learners process and retain information. These theories provide the basis for explaining what it is about graphic organizers that supports the learning process and consequently aids in the comprehension, recall, and retention of information.

The discipline of cognitive science deals with the mental processes of learning, memory, and problem solving (Cooper, 1998). The theories reviewed in this section include the following: dual coding theory, schema theory, and cognitive load theory. For purposes of this paper, a theory is defined as the set of principles, facts, or hypotheses that help to explain how information is processed and how learning occurs. In turn, the use of graphic organizers is an instructional strategy that has been developed based on the learning theories.

Dual Coding Theory

Paivio (TIP: Theories, 1994-2003, http://tip.psychology.org/sweller.html) is given credit for developing the dual coding theory. This theory assumes that memory consists of two separate but interrelated systems for processing information. One of those systems is verbal, the other nonverbal. Some scholars refer to the systems as linguistic and imagery or nonlinguistic (Marzano et al., 2001). Even though they can be activated independently, there are connections between the systems that allow dual coding of information. The verbal system specializes in processing and storing linguistic information such as words and sentences, which are represented as logogens (elements of the verbal system) when they are stored in memory. The visual system processes images and they are represented as imagens (elements of the imagery system) in memory (Wang, 1994).

Several other principles of dual coding theory are instrumental in understanding the implications the theory has for learning, and particularly for the use of graphic organizers. The processing of verbal and/or visual information can occur on three different levels. Representational processing refers to the activation of verbal or nonverbal representations, depending on the corresponding type of stimuli. Referential processing is the activation of the verbal system by the nonverbal system or vice versa (TIP: Theories, 1994-2003, http://tip.psychology.org/sweller.html). Associate processing is the activation of representations within either system.
Saavedra (1999), in her paper reviewing dual coding theory, states that proponents of the theory believe that dual coded information is much easier to retain and retrieve because of the availability of two mental representations (verbal and visual) instead of one. Also, the processing of images is more likely to activate both coding systems than are words alone. And, the more we use both forms, the better we are able to think about and recall information (Marzano et al., 2001). The theoretical underpinnings of dual coding theory have implications for the use and value of graphic organizers for instruction. Graphic organizers are important in the processing and storing of information so that it can be retrieved for use at a later time. Marzano and others (2001) state research indicates that graphic organizers “enhance the development of nonlinguistic representations in students, and therefore, enhance their development of that content.” (p. 73) The use of graphic organizers also helps students generate linguistic representations. As visual learning tools, they can help learners process nonverbal information; and since they tend to be text-based, they have an added advantage of helping learners process verbal information as well.

**Schema Theory**

According to schema theory, the memory is composed of a network of *schemas*. Doyle (1999) describes a schema as “skeletal frameworks containing categories for specific information . . . Existing schema and the information contained within are known as prior knowledge.” Even though many descriptions of schemas exist, Winn and Snyder (1996) state that all descriptions include the following characteristics:

1. A schema is an organized structure that is a part of our memory. Combined with all other schemas, it contains the sum of an individual’s knowledge.

2. Schema can be understood as a network of concepts connected by links. Schema consists of nodes and links that describe the relations between node pairs.

3. Schema is formed through generalities or abstractions as opposed to specificity of information. For example, when we look at a cat, we observe many features such as color, size, breed, etc. The schema that we have constructed from experience to represent “cat” in our memory does not contain all these details. Our “cat” schema will tell us it has eyes, four legs, and raised ears.

4. Schemas are dynamic structures. As new information is learned it is, to use Piaget’s terms, assimilated and accommodated into existing schemas or the formation of new schemas.

5. Schema provides a context that affects how new experiences are interpreted. For example, when reading material with which one is not familiar, the information will be interpreted based on existing schemas.
According to Dye (2000), “The graphic organizer has its roots in schema theory.” Linking new information to existing knowledge is one way teachers can help students learn new information. To help students make these links, teachers need to present the material in ways that facilitate such learning. Graphic organizers can help students link their existing knowledge to new knowledge and help them build the schema they need to understand concepts, according to research conducted by Guastello and others (2000).

Schema theory emphasizes the importance of activating prior knowledge when reading. If prior knowledge is activated, the schema will provide a framework on which new knowledge can be attached and, consequently, comprehension will be improved. The implication is that graphic organizers can facilitate this learning (Doyle, 1999; Robinson, 1998). When used as an advance organizer to the information to be learned, research has shown that graphic organizers can improve student achievement (Willerman & Mac Harg, 1991).

Cognitive Load Theory

Simply defined, cognitive load is the amount of mental resources necessary for information processing (Adcock, 2000). Cognitive load theory maintains that working memory can deal with a limited amount of information, and if that capacity is exceeded, the information is likely to be lost. The limitations of working memory are bound by the types of schema a learner has, or by a learner’s prior knowledge.

According to several researchers, implications from theories about cognitive load can be applied to instructional design (Cooper, 1998; Wilson & Cole, 1996; Yu, 2002). These researchers believe visual learning tools such as graphic organizers can reduce the cognitive load (i.e., the number of items to be attended to and processed by working memory). However, understanding cognitive load theory and, in turn, its implications for graphic organizers requires the description of several key principles. Cognitive load theory maintains that working memory can deal with a limited amount of information, and if that capacity is exceeded, the information is likely to be lost. Working memory has a threshold of somewhere between 4 and 10 elements. The definition of an element depends on the schemas of the individual learning the information. It depends on the schema of the learner because, generally, elements are schemas (Cooper, 1998). This leads into a brief definition of a schema and schema theory. Dunston (1992) states:

Schema refers to how knowledge of concepts is organized and stored in memory. A schema is a skeletal framework containing categories, or slots, for specific information. The quantity, quality, and boundaries of the categories within a schema are, for the most part, determined by personal experiences.

Therefore, the limitations of working memory are bound by the types of schemas a learner has or, in other words, the prior knowledge possessed. An expert in a particular area will have expansive schemas, or information networks, and have a high level of automation, or ability to perform tasks without concentrating (Wilson & Cole, 1996). Another principle that must be understood is element interactivity. Element interactivity refers to the relationship between elements (Cooper, 1998). Some information is
extremely difficult to learn because there is a need to attend to the relationships between the elements. Schemas, or information networks, provide the ability to combine many elements into a single element and the capacity to incorporate the interactions between elements (Cooper, 1998).

With the key principles defined, now the definition of cognitive load is presented. According to Cooper (1998), “Cognitive load refers to the total amount of mental activity imposed on working memory at an instance in time. The major factor that contributes to cognitive load is the number of elements that need to be attended to.” (p. 10) Consequently, for a novice learner who doesn’t have the schemas of an expert, the information to be learned will have a higher cognitive load than for an expert. The novice will not be able to process the same number of elements (and the definition of an element may differ because of the lack of schemas) nor the same number of interactive elements as an expert who has acquired the schemas.

Before describing the instructional implications, two more concepts must be introduced: intrinsic and extraneous cognitive load. Intrinsic cognitive load refers to the difficulty of the content to be learned. It cannot be modified by instructional design. In other words, some content is going to be difficult to learn no matter how it is presented. Extraneous cognitive load refers to how much demand is placed on working memory to learn the new material (Cooper, 1998). The level of extraneous cognitive load may be modified through different types or modes of instruction, thus facilitating student learning. In other words, learning some content may be easier for students if the extraneous cognitive load is lessened by changing or modifying how the material is presented.

Several articles (Cooper, 1998; Wilson & Cole, 1996; Yu, 2002) have recounted the instructional techniques proposed by the theorist Sweller that make use of what is known about cognitive load theory. Five effects are generated by using alternative instead of traditional instructional techniques. The effects and descriptions of standard and alternative instructional practice are presented below. At least two of these techniques have inferences for graphic organizers (see asterisked items).

1. **Goal-Free Effect.** Instead of the standard practice of using conventional problems, which specify the goal so that students know what they have to find, use goal-free problems. If problems are “goal free” then a problem solver has to focus on the information provided and use it wherever possible. This is a forward working solution approach and, as such, imposes low levels of cognitive load.

2. **Worked Example Effect.** Instead of having students learn by solving many problems, have students learn by studying worked examples. Studying worked examples places a lower level of cognitive load on the learner.

3. **Split Attention Effect.** The standard practice for instructional materials that require both textual and graphical sources of instruction is to present the text and graphics in separate locations (e.g., beside, below, above). This produces a split attention effect where the student needs to attend to both the graphic
and the text. Therefore working memory must attend to the text, graphic, and
the integration of the multiple sources of information. An alternative approach
is to integrate the text into the graphic so that the relationships between the
textual and graphical components are clearly indicated.

4. **Redundancy Effect.** Standard practice dictates the same information should
be presented in several different ways at the same time. Although there are
benefits to integrating text and graphics, one needs to make sure that both
sources of information are essential for learning to occur. Attending to both
text and graphic sources of instruction requires more mental resources than
attending to a single source, which in turn reduces the amount of working
memory available for learning.

5. **Modality Effect.** Traditionally, similar information was presented in an
identical media format to ensure consistency in the instructional presentation.
Based on what is known about working memory, it appears that at least some
portions are sensory-mode specific. In other words, some portion of working
memory is dedicated to attending to visual information only, and some portion
of working memory is dedicated to attending to verbal information.

Of the five instructional strategies and the effects they have on lessening the extraneous
cognitive load on working memory, two have the greatest implications for the
development and use of graphic organizers as an instructional tool—the split attention
effect and modality effect. To some extent, the redundancy effect does as well, but more
in a cautionary manner.

Adcock (2000) reviewed a number of experimental studies that examined the effect of
presentation modality and split attention and the impact on information processing and
cognitive load. Each of the studies did provide support for reducing the cognitive load,
either through using different modalities or split attention.

One of the studies found that geometry students performed better when presented
information in two different modalities (e.g., visual diagram and auditory explanations).
It was deduced that the dual presentation decreased the cognitive load on working
memory so that the students were able to process both formats at the same time.

Another study tested the cognitive load theory and working memory in terms of a split
attention effect. This study tested a dual presentation mode, and the researchers
concluded that when different sources of information are presented in the same
modalities, working memory is overloaded and deep processing cannot occur (e.g., visual
and text).

A third study looked at how presentation format affects reasoning ability. It was
hypothesized that individuals would show better reaction times and lower effort rates
with pictorial material, and the hypothesis was proven correct.
In looking at the split attention effect, a final empirical study found that the level of the individual’s expertise affected the impact of cognitive load. For individuals with a low amount of expertise, an integrated format (e.g., integration of text and diagrams) that reduced the split attention effect was more effective. However, for a person more familiar with the material, there was a negative redundancy effect and a negative impact on learning.

**Summary**

Three learning theories have been reviewed that help to explain the “why” and “how” of what makes graphic organizers an important learning tool.

Dual coding theory asserts that if individuals attend to both the nonverbal and verbal systems of processing information, the retention and recall of information is easier. Schema theory proposes that the use of a graphic organizer helps students link existing knowledge—organized in networks or schemas in our memories with new knowledge.

Finally, cognitive load theory states working memory has a maximum capacity of information it can process. Graphic organizers can help reduce the cognitive load and, as a result, allow more of the working memory to attend to learning new material.

The intent of this overview of the three cognitive learning theories has been to provide a foundation for understanding why the use of graphic organizers may be an effective teaching and learning strategy. The remainder of this review looks at findings from SBR conducted in kindergarten through 12th grade classrooms where graphic organizers have been used.

**SBR on the Use of Graphic Organizers for Literacy Development**

This section of the literature review examined 10 studies, one meta-analysis of studies, and two reports that described the uses of graphic organizers for literacy development. For this discussion, literacy development is defined by Inspiration Software, Inc. as vocabulary development, early reading comprehension (kindergarten through second grade), reading in other grades (3-12), and writing skills.

**Vocabulary Development**

One quasi-experimental SBR study and a meta-analysis of 23 studies (Moore & Readence, 1984) concluded that graphic organizers moderately affect vocabulary test scores.

The quasi-experimental SBR study (part of several teachers’ master’s project) was designed to test whether elementary and junior high students’ reading comprehension and vocabulary skills could be improved through the use of graphic organizers (Brookbank et al., 1999). Over the course of 16 weeks, the teacher-researchers introduced the students in their four classrooms (first, second, fifth, and seventh grades; number of students not
specified) to a number of different graphic organizers as they taught them how to clarify and understand concepts; show sequence and order; depict main ideas, details, and their relationships; compare and contrast elements; and make analogies. Using pre- and post-observation checklists, the effect of graphic organizers on the development of vocabulary skills was assessed. Findings indicated that graphic organizers helped at least 80% of students at all grade levels master key vocabulary skills. A positive unrelated finding: students enjoyed sharing their graphic organizers with their classmates and helping each other learn.

**Early Reading Comprehension**

Two quasi-experimental SBR studies (Brookbank et al., 1999; Sinatra et al., 1984) found that graphic organizers helped improve the reading comprehension of students with learning disabilities in grades two through eight as well as two classes of first and second graders. These conclusions were drawn based on results of reading comprehension posttests. The particulars for each of these studies are described below.

One of the quasi-experimental SBR studies was conducted with students who were referred to a university reading clinic (grades two through eight). The study used semantic mapping as a prereading strategy, in comparison to a verbal readiness approach for improving reading comprehension, with 27 students in grades two through six (Sinatra et al., 1984). Breakdowns by grade levels were not given; however, the mean age of the students was 10. Results of the postcomprehension scores revealed the mean number of comprehension questions correct for students using the semantic map approach was significantly higher than that of those using the verbal readiness approach.

The second quasi-experimental SBR study was conducted with one first- and one second-grade classroom (number of students not specified) as well as one fifth- and one seventh-grade classroom (Brookbank et al., 1999). A number of graphic organizers were introduced to students throughout a semester as a strategy to improve reading comprehension and vocabulary. Comparisons of pre- and postreading comprehension tests revealed both first- and second-grade students showed gains on their tests.

A third reference, *Put Reading First: The Research Blocks for Teaching Children to Read (Kindergarten through Grade 3)*, developed by the Center for the Improvement of Early Reading Achievement (CIERA) and published by the Partnership for Reading, based findings and conclusions on the 2000 report of the National Reading Panel (NRP). This report cited graphic organizers as an effective instructional strategy for improving text comprehension. The majority of scientific research studies reviewed by the panel were with fourth through sixth graders. One of the 10 SBR studies reviewed was at the second-grade level and none were at kindergarten or first-grade level. NRP also suggested in this report that graphic organizers are most effective at upper elementary and middle level grades for reading comprehension.
Reading Grades 3-12

The seven SBR studies (four quasi-experimental, three experimental) included in this section (Berkowitz, 1986; Bowman et al., 1998; Davis, 1994; Darch et al., 1986; Gordon & Rennie, 1987; Reutzel, 1985; Troyer, 1994) specifically examined the effectiveness of graphic organizers on improving students’ reading comprehension in grades 3 through 12. In addition to these studies are the key findings from a report released by the National Reading Panel (2000). Following a review of the research literature on vocabulary and text comprehension instruction, the National Reading Panel (2000) cited graphic and semantic organizers (including story maps) as one of seven categories of instruction found to be most effective in the improvement of reading comprehension. Review of the seven SBR studies as a part of this analysis concurred with these findings. Following are highlights from the seven SBR studies and the NRP report.

Based on a review of 10 SBR studies, NRP reported that graphic maps facilitate memory and content area achievement, help students organize their ideas about what they are reading, and, most importantly, are a “proven procedure that enhances comprehension for text.” As was found from the research reviewed in this paper (see Curriculum-Specific Uses for more details) and concluded by NRP, graphic organizers are particularly suitable for comprehending expository text in science and social studies.

One SBR (experimental) study used story maps as a prereading strategy with third- and fifth-grade students, compared to a directed reading activity (DRA) (Davis, 1994). The study involved 66 third-grade and 60 fifth-grade students. The students were randomly assigned to one of two treatment groups (e.g., treatment and control groups for third grade and for fifth grade). At the conclusion of the intervention, it was found that performance on the literal and inferential comprehension tasks was higher for the third-grade students where story maps had been used, compared to DRA. However, no differences were found between the two treatments in the performance of the fifth-grade students. Gardill and Jitendra (1999) concluded that story mapping is a specific type of graphic organizer that has been found to be effective with students in the elementary grades in the area of reading comprehension as well as with students with learning disabilities.

Another SBR study (quasi-experimental) also compared the use of a DRA and story maps with 102 fifth-grade students (Reutzel, 1985). Comparisons of the mean number of propositions recalled by the two groups (DRA and story map) were significantly higher for the story-mapping group. Reutzel (1985) concluded that story maps could be used to improve comprehension of both narrative and expository text. According to this researcher, some of the benefits of story maps for teachers and students include the ability to:

- plan and execute more purposeful, focused reading lessons.
- organize readers’ efforts toward specific comprehension objectives.
- focus questions and discussions on the important aspects of the text.
- provide a visually coherent summary of the text.
- give a structure for guiding prereading experiences.
• encourage students to think about and monitor their reading.

In another SBR study (quasi-experimental), cooperative learning groups, higher order thinking skills, and graphic organizers were used as strategies to improve sixth-grade students’ reading comprehension (Bowman et al., 1998). The total number of sixth-grade students participating in the study is not known. The three interventions were introduced to the students at the beginning of a semester, along with three pretests. Throughout the semester, the interventions continued to be used as a part of instruction. Following the conclusion of the semester, the tests were readministered. Comparison of pre- and posttest scores on the Houghton Mifflin Periodic Reading Survey—the measure used to assess whether implementing graphic organizers increases reading comprehension—revealed that the class average increased significantly.

Reports of success with graphic organizers as a part of content reading from expository texts can be found in a number of SBR studies (see Curriculum-Specific Uses for more detailed information). A case in point is an experimental SBR study that investigated the effectiveness of four different strategies (graphic organizer/group, graphic organizer/individual, directed reading, and SQ3R) with sixth graders (Darch et al., 1986). A total of 84 sixth-grade students participated in the study. The use of the graphic organizer strategy was found to be more effective in facilitating comprehension of content area information as measured by both a posttest and transfer test.

Similarly, Berkowitz (1986), in a quasi-experimental SBR study, compared the use of concept maps with more traditional approaches to content reading. A total of 99 sixth-grade students participated in the study. The four classes were assigned one of four instructional procedures: (1) map construction (students constructed their own maps following instruction on map construction), (2) map study (students received a prepared map of the material from which to study), (3) question answering, and (4) rereading. Students who used mapping methods had higher scores on immediate free-recall tests than students using a more traditional approach to content reading (e.g., question answering and rereading procedures). However, the question-answering group gave significantly more correct responses than the map-study group on the free-recall test.

Graphic organizers again surfaced as an effective strategy for reading comprehension, compared to the use of mental modeling (think-aloud technique) or question/answering, when used with fourth- through sixth-grade students in the area of content reading (Troyer, 1994). The quasi-experimental SBR study involved a total of 173 students (48 fourth-grade students, 75 fifth-grade students, and 50 sixth-grade students). Grade level classes were assigned to one of three conditions: mental modeling, graphic organizer, or control read/answer group. Students in all three groups received instruction in the characteristics of three different text organizational patterns: attribution, collection, and comparison. Following each of the instructional treatments, students in all three groups completed a posttest and writing sample. The graphic organizer group outscored the read/answer group on the attribution, collection, and comparison tests.

Using a slightly different slant at using graphic organizers, one experimental SBR study looked at how graphic organizers could restructure fifth-grade students’ misconceptions about content (Gordon & Rennie, 1987). The 23 fifth-grade students selected to
participate in the study were randomly assigned to one of three treatment groups: (1) experimenter reading while the students followed the expository text, (2) experimenter reading while the students followed the expository text and a semantic map was referenced depicting the key concepts and their relationships, and (3) control group that read and recalled the expository text. Posttest results indicated that students using a semantic map as a part of reading expository text were able to restructure their existing schemas where they had stored the misconceptions on this particular topic or create new schemas so as to take into account the new, correct knowledge and clarify the previous misconceptions they had maintained.

Writing Skills

The two final SBR studies (Gallick-Jackson, 1997; Meyer, 1995) in this literature review examined the effects of graphic organizers as a part of the writing process. The two quasi-experimental studies were conducted with second- and third-grade students as part of two teacher’s master’s projects. Results of posttests and writing samples revealed students’ writing skills improved. The particulars for each of these studies are described below.

Intended to improve the narrative writing and composition skills of second-grade students, one quasi-experimental SBR study integrated word processing, graphic organizers, and art into a writing process (Gallick-Jackson, 1997). Following a 12-week intervention period, posttests were given to assess students’ narrative writing skills and writing composition skills. Results indicated that narrative writing and writing composition skills improved. Graphic organizers not only helped students in structuring and organizing information but also in brainstorming ideas. These students also exhibited increases in positive attitudes toward writing as measured by an attitudinal survey.

A second quasi-experimental SBR study used graphic organizers as a tool for improving creative writing in third-grade students (Meyer, 1995). Two third-grade classes were involved in the study. One class received instruction in graphic organizers and the other did not. Comparison of pre- and posttests found that students who had used the graphic organizers showed improvement in their creative writing.

Summary

Some SBR studies have shown graphic organizers to improve vocabulary development and positively affect test scores. Other SBR studies have found students’ writing skills to improve as a result of using graphic organizers as a part of the writing process.

When defining reading comprehension to include reading across the content areas, numerous studies have found graphic organizers to be an effective strategy for improving students’ comprehension of information. Judging by the number of SBR studies conducted, graphic organizers appear to be used and effective for reading across the curriculum in the middle level grades. The National Reading Panel (2000) concurred, saying graphic organizers are generally used as an instructional technique in the higher elementary and middle school grades.
SBR on the Use of Graphic Organizers for Thinking and Learning Skills

Although many studies had the fundamental goal of improving student performance in a particular content area, some of the studies focused on improving students’ thinking and learning skills as well. Inspiration Software, Inc. requested that thinking and learning skills be defined to include critical thinking skills, retention and recall of information, problem-solving skills, and note taking. This section summarizes what has been found about how graphic organizers are beneficial to students in the four above-mentioned skill areas.

Critical Thinking

Two SBR studies (Brookbank et al., 1999; DeWispelaere & Kossack, 1996) examined how critical thinking skills or higher order thinking skills were enhanced as a result of using graphic organizers. Critical thinking skills, as defined by Inspiration Software, Inc., include the ability to identify cause-effect relationships; make predictions; draw inferences; and analyze, synthesize, or evaluate information. Higher order thinking skills are similarly defined and are sometimes used interchangeably with critical thinking skills. Higher order thinking skills generally include skills such as being able to analyze, compare, evaluate, make inferences, and synthesize— in other words, constructs corresponding to the upper levels of thinking on Bloom’s Taxonomy. Findings from the two quasi-experimental SBR studies indicated that graphic organizers enabled students to improve critical thinking and higher order thinking skills as measured by teacher observations and student performance on classroom projects. Specifics of the two studies are presented below.

Brookbank and three other teachers (1999), as a part of their master’s project, introduced graphic organizers in their first-, second-, fifth-, and seventh-grade classrooms as a strategy to improve reading comprehension and vocabulary skills. Using a quasi-experimental research design, the teacher-researchers introduced their students (number of students was not specified) to several different graphic organizers for completion of the following learning tasks: comparing and contrasting, sequencing, part/whole relationships, classification, and analogies. Informal observation checklists were used to assess the effectiveness of graphic organizers as a strategy for completing the above-mentioned tasks. At least 80% of the first-, second-, fifth-, and seventh-grade students participating in the study attained mastery for the following areas: comparing and contrasting, sequencing, and part/whole relationships. At least 80% of the fifth- and seventh-grade students also attained mastery for classifications and analogies.

Another SBR study (two teachers’ master’s project) specifically incorporated the use of graphic organizers in junior high and high school Spanish classrooms (number of students not specified) to improve higher order thinking skills (DeWispelaere & Kossack, 1996). These two teacher-researchers concluded, on the basis of the study’s findings, that retention of information enhances student transfer of knowledge and higher order thinking skills when adequate time is allowed to learn the graphic organizer. Findings from their quasi-experimental study indicated that, as a result of using graphic organizers,
students showed improvement in higher order thinking skills on not only classroom quizzes and tests but also in their course projects.

Retention and Recall

Three SBR studies (Bos & Anders, 1992; Ritchie & Volkl, 2000; Griffin et al., 1995) examined the effects of graphic organizers on retention and recall. Overall findings of the three studies (two quasi-experimental, one experimental) indicated that graphic organizers improve student retention and recall of information for both elementary and junior high students with learning disabilities as well as upper elementary students (fifth and sixth grade). Follow-up tests at various intervals following instruction found that students better retained information they had learned through the aid of graphic organizers. In one study, graphic organizers were also found to have assisted students in transferring these skills to new situations (Griffin et al., 1995). The particulars for each of these studies are described below.

One SBR study (quasi-experimental) tested the effects of interactive teaching strategies versus instruction emphasizing definitions on elementary, bilingual social studies students with learning disabilities and other students with learning disabilities in junior high science classes (Bos & Anders, 1992). The 103 students in the study (42 bilingual elementary and 61 junior high students) participated in one of three interactive teaching strategy groups using semantic mapping—semantic feature analysis, semantic/syntactic feature analysis, or contrast instructional condition-definition instruction. Simple effect sizes for the interactive teaching strategies compared to definition-instruction on both the posttests and follow-up test were substantial, leading the researchers to conclude that interactive strategies are more effective for students with learning disabilities when learning content area concepts.

A second SBR study (experimental) that used graphic organizers as a learning strategy in a sixth-grade science classroom (77 students) also found that students who started out with concept maps and then did lab experiments showed higher achievement on the delayed posttest than students who did their lab experiments first and then used concept maps (Ritchie & Volkl, 2000). The researchers concluded that the sequence made a difference because the concept maps expanded the students’ mental models, and therefore the students had a better mental network to support learning more detailed information that was presented in the lab experiment.

In a third SBR study (quasi-experimental), fifth-grade students who had received prior instruction using graphic organizers were asked to read and recall novel content in an expository text (Griffin et al., 1995). Test results demonstrated that students with the graphic organizer instruction recalled more idea units than did students who had received traditional instruction. A total of 86 fifth-grade students from five classrooms participated in the study.
Problem-Solving

Findings from the one SBR study (quasi-experimental) included in this section demonstrated that students’ problem-solving skills improved as a result of using graphic organizers (Braselton & Decker, 1994). Because of the effectiveness of graphic organizers in improving reading comprehension, Braselton and Decker (1994) decided to incorporate graphic organizers in fifth-grade mathematics word problem lessons.

Outlining

Two quasi-experimental SBR studies (Doyle, 1999; Meyer, 1995) used graphic organizers as an outlining tool. One study used graphic organizers with eight learning-disabled senior high students in the area of social studies. The second study, which integrated graphic organizers as a part of the creative writing process, was conducted with a class of third-grade students. The first study concluded that graphic organizers are a viable alternative to conventional note taking, as shown by results of the end-of-chapter test. Graphic organizers also assisted students in the writing process, as measured by writing samples. The particulars of those studies are described below.

As an alternative approach to the traditional method of having content presented through lecture, text, and linear note taking, eight students with learning disabilities in a quasi-experimental SBR study conducted by Doyle, as a part of her master’s thesis (1999), were taught social studies content through the use of graphic organizers. The teacher-researcher utilized two different types of interventions with senior high students. In the first intervention, she used a teacher-generated, partially completed graphic organizer. After explaining the content and relationships, in a discussion format, students filled in the remainder of the graphic organizer. She then had the students work in pairs and on their own to complete two blank graphic organizers. For the second intervention, the teacher introduced different parts of the text through a lecture mode of instruction and had the students copy notes she had written on the board. Upon completion of each chapter of text presented through the two interventions, the participating students took a chapter textbook test. Students received higher scores on postinstruction tests when graphic organizers were used compared to the more traditional lecture and note taking method of information presentation.

Graphic organizers have also been useful for helping students organize their writing. A quasi-experimental SBR study conducted with third-grade students, as a part of a teacher’s master’s project, used graphic organizers as a tool during creative writing (Meyer, 1995). The teacher-researcher taught writing to two different third-grade classes (number of students not specified) using two different techniques. For the experimental group, the teacher initially modeled the use of a graphic organizer. The class discussed how to use a graphic organizer and then, as a class, chose a topic for the creative writing story and together completed a graphic organizer and wrote the story. The children were then asked to complete their own graphic organizers prior to creative writing assignments for the course of 12 weeks. The control group was taught the writing process without the use of a graphic organizer. Comparisons of pre- and posttest writing samples at the end of
the instructional period revealed that the use of graphic organizers significantly improved the experimental group’s creative writing skills.

Summary

The process of using a graphic organizer has been shown to develop students thinking and learning skills in specific content areas. Research has also shown that graphic organizers can enhance students’ skill development in these areas: critical thinking skills, retention and recall of information, transfer of what is learned to a new situation, problem solving, organization of ideas, and outlining writing and key concepts.

SBR on the Use of Graphic Organizers in Other Classroom Work

For purposes of this section, the articles reviewed include those relating to (1) curriculum-specific uses of graphic organizers (excluding literacy), (2) grade-specific uses, and (3) special population-specific uses. A total of 18 SBR articles on the use of graphic organizers in the classroom are summarized in this section.

Curriculum-Specific Uses

The predominant area of study on the use of graphic organizers appears to be in reading and writing (which will be reviewed in the fourth section of this literature review). However, a number of studies have been conducted in the science and social studies content areas. These studies typically used graphic organizers to help students read expository text. Under those conditions, the studies could be classified as both reading and content area, but for purposes of this literature review, they are discussed within this section. Two studies were found that used graphic organizers in other content areas such as mathematics (one SBR study) and Spanish (one SBR study).

Science

Five SBR studies (Guastello et al., 2000; Hawk, 1986; Ritchie & Volkl, 2000; Simmons et al., 1988; Willerman & Mac Harg, 1991) focused on the use of graphic organizers to facilitate middle level students’ learning of science content (sixth, seventh, and eighth grade). Findings from these studies (three quasi-experimental, two experimental) indicated that the use of graphic organizers in science is an effective way to improve student comprehension and retention of material. Additionally, students who used concept maps scored higher on posttests than those who received more traditional types of instruction. The particulars for each of these studies are described below.

In one quasi-experimental SBR study, the effectiveness of three instructional procedures for assisting sixth graders’ comprehension and retention of science content was compared (Simmons et al., 1988): (1) teacher-constructed graphic organizers before textbook reading; (2) teacher-constructed graphic organizers after textbook reading; and (3) a traditional form of instruction (e.g., frequent questions and text-oriented discussion before, during, and after textbook reading). Three sixth-grade classrooms with a total of
49 students participated in the study. Results of the study indicated that the placement (i.e., position or timing) of the graphic organizer in the text reading was a significant factor in determining student performance on a delayed posttest. The use of the graphic organizer before text reading appeared to be more effective in the recall of text material, as measured by the delayed posttest. Interestingly, results from the immediate posttest produced no significant differences in performance among the three instructional procedures.

A second SBR study assessed the effectiveness of concept mapping and laboratory experiments with 77 sixth graders to determine if either one is more effective with individual learners or learning groups (Ritchie & Volkl, 2000). In this experimental study, students were exposed to both experimental treatments but in differing order. Results of a delayed posttest found that students who started with concept maps and then went on to the lab experiment showed higher achievement on the delayed posttest. The researchers concluded that creating concept maps before engaging in experiments produces better long-term retention. They attributed this finding to students’ mental models becoming more extensive as a result of the concept mapping activity.

Another SBR study (quasi-experimental) that used concept maps as an advance organizer found that concept maps also improved science achievement (Willerman & Mac Harg, 1991). The eighth-grade students in this study were either in the experimental (concept map) or control group. A total of 82 eighth-grade students in four physical science classes participated in the study. The experimental group completed a concept map at the beginning of the science unit, whereas the control group did not. The concept mapping group performed significantly higher on the posttest.

The fourth SBR study (experimental) used concept maps with low-achieving seventh graders and found concept mapping to be an effective tool to improve comprehension of science content (Guastello et al., 2000). The 124 seventh-grade students who participated in the study were assigned to one of two groups: mapping or a traditional, read-and-discuss. Posttest scores were higher for the concept mapping group, indicating that instructional techniques using graphic representations are more effective than more traditional methodologies (e.g., teacher-directed question/discussion formats with no concept mapping). The authors suggested that concept mapping, if used to teach textual material, might assist students to build schemas for understanding a lesson’s concepts. Furthermore, the process of creating the semantic map may simply serve to focus students’ attention on the relevant sections of the text (Guastello et al., 2000).

The fifth SBR study (quasi-experimental) involved students in upper level sixth and seventh grade life science classes, and examined the effectiveness of graphic organizers on student achievement (Hawk, 1986). A total of 455 students from 15 classes (seven classes of life science at four middle schools and eight classes of life science at four other middle schools) were in one of two groups: one group received graphic organizers at the beginning of a chapter; the other (control) group did not receive graphic organizers. Students in classes that used graphic organizers scored significantly higher on posttests than students in the control group. The conclusion drawn from this study was that the graphic organizer is an effective and practical teaching strategy. Hawk’s rationale was
that graphic organizers provide an overview of material to be learned and a framework that in turn provides reference points to aid the learner in assimilating the new vocabulary and organizing the main concepts into a logical pattern. Graphic organizers also prompt students regarding what to look for as they read written material (Hawk, 1986).

**Social Studies**

Four SBR studies (Alvermann & Boothby, 1983; Alvermann & Boothby, 1986; Armbruster et al., 1991; Griffin et al., 1995) in the area of social studies used graphic organizers to assist students in organizing information from expository texts and in the comprehension of content area reading. All four studies were conducted with either fourth- or fifth-grade students. Findings from the four studies (two quasi-experimental, two experimental) found that graphic organizers aided students with the selection and organization of information as well as the recall of relevant information, as measured by posttests. Students were also able to transfer the thinking and learning skills to novel situations and content. The particulars for each of these studies are described below.

The first SBR study (quasi-experimental), which looked at the effects of using graphic organizers in fifth-grade history instruction, was designed to answer two questions: Does graphic organizer instruction facilitate comprehension, recall, and transfer of information contained in an expository textbook? And to what degree is explicit instruction necessary for independent generation and use of graphic organizers by students? (Griffin et al., 1995). The researchers used four experimental conditions: they had students read social studies information with and without a graphic organizer, as well as with and without explicit instruction in the use of graphic organizers. A total of 86 fifth-grade students from five classrooms participated in the study. A control group received traditional basal instruction. Results on the posttest indicated that all groups performed comparably on acquisition and retention measures. Students receiving the graphic organizer and explicit instruction performed better on the transfer measure (e.g., reading and recalling novel social studies content) than students who received traditional basal instruction. The researchers concluded that “the explicitness of instruction and or the graphic organizer played important roles in students’ ability to generalize the instruction to novel textual material” (p. 105).

The second SBR study (quasi-experimental) tested the effectiveness of instructional graphics on fourth- and fifth-grade students’ ability to learn from reading their social studies textbooks (Armbruster et al., 1991). In this study, the instruction graphic used was a frame—a visual representation of the organization of important ideas in a textbook. A total of 365 children from 12 classrooms (164 fourth-grade and 201 fifth-grade students) participated in the study. Students in the framing conditions scored higher on recognition and recall tests than did students in the control group. The researchers concluded that frames help readers with selecting and organizing information from the text.

The third SBR study (experimental), conducted with 33 fourth-grade students considered to be above average in ability and reading achievement, investigated differences in students’ retention of “inconsiderate” social studies text (Alvermann & Boothby, 1983). Inconsiderate text is defined as containing irrelevant information. Students in the
experimental group received instruction in the use of a graphic organizer, whereas those in the control group did not. Results of a free recall measure found graphic organizers to be effective in reducing the amount of irrelevant information retained from inconsiderate text.

The fourth SBR study (experimental) examined the transfer effects of graphic organizer instruction on 24 fourth-grade students’ ability to comprehend and retain social studies material (Alvermann & Boothby, 1986). Students in the experimental group, who received more graphic organizer instruction, comprehended and recalled significantly more information than those who received no instruction in the use of text structure, as measured by a criterion-free recall assessment.

Other Content Areas

Teachers in content areas other than reading, writing, social studies, and science have also incorporated graphic organizers into their instruction and student learning experiences. This review includes two SBR studies in “other” content areas (i.e., mathematics and Spanish) that found graphic organizers to be advantageous in improving students’ problem-solving skills and higher order thinking skills, and to their learning of technical vocabulary. The particulars for each of these studies are described below.

One of the SBR studies (quasi-experimental) was in the area of mathematics. In an SBR study targeting fifth graders (one classroom, number of students not specified), a teacher-researcher and university researcher focused on improving students’ reading and comprehension of mathematics problems (Braselton & Decker, 1994). The teacher-researcher chose to use graphic organizers as an instructional strategy because of their effectiveness in improving content area reading comprehension in visually relating elements of a story. Explicit instruction, modeling, guided practice, and independent practice were given on the graphic organizer. Following the independent practice, the teacher-researcher claimed “students showed marked improvement in problem solving” and that the strategy was effective with students across all ability levels.

In an SBR study (quasi-experimental) using graphic organizers with a Spanish-as-a-second-language class, two teachers (as a part of a master’s thesis project) wanted to improve their students’ higher order thinking skills (DeWispelaere & Kossack, 1996). The study involved one junior high and one high school Spanish class. The number of students enrolled in each class was not specified. The teachers presented 14 different graphic organizers that represented key skills in sequencing, comparing and contrasting, and classifying. The students also developed their own graphic organizers. To assess whether graphic organizers increased higher order thinking skills, chapter quizzes and tests and student projects were used as assessment measures. Student improvement was noted in all areas of assessment. The conclusion reached by the teachers was that graphic organizers helped improve higher order thinking skills.
Summary

The benefits of graphic organizers across several content areas, including science, social studies, math, and Spanish, have been verified by several SBR studies. Graphic organizers have been found to improve student performance or assist students in the areas of:

- comprehension of content.
- development of skills and strategies for comprehension.
- problem solving.
- retention and recall of information.
- improvement of higher order thinking skills.
- creating schemas to accommodate new information.
- seeing connections, patterns, and relationships.

Grade-Specific Uses

Although the majority of the SBR studies of graphic organizers included in this review involve students in the upper elementary or middle level grades, some SBR studies involve lower elementary age and high school students. These too have shown graphic organizers to be effective learning tools. Table 1 displays the graphic organizer studies by grade level. Specifics of each of these studies are discussed in more detail in other sections of this paper (e.g., curriculum-specific uses, special student populations, thinking and learning skills, and literacy development).

Table 1

<table>
<thead>
<tr>
<th>Grade</th>
<th>Studies</th>
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<tr>
<td>K</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>Brookbank et al., 1999</td>
<td>1</td>
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</tbody>
</table>
| 2     | Brookbank et al., 1999  
   Gallick-Jackson, 1997  
   Sinatra et al., 1984 | 3     |
| 3     | Davis, 1994  
   Meyer, 1995  
   Sinatra et al., 1984 | 3     |
| 4     | Alvermann & Boothby, 1986  
   Alvermann & Boothby, 1983  
   Armbruster et al., 1991  
   Scanlon et al., 1992  
   Sinatra et al., 1984  
   Troyer, 1994 | 6     |
| 5     | Armbruster et al, 1991  
   Braselton & Decker, 1994  
   Brookbank et al., 1999  
   Davis, 1994  
   Gallego et al., 1989  
   Gordon & Rennie, 1987 | 12    |
<table>
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<th>Grade</th>
<th>Studies</th>
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<tbody>
<tr>
<td>Grade level not specified</td>
<td>Bos &amp; Anders, 1992 (upper elementary)</td>
<td>1</td>
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</table>

**Summary**

All of the SBR studies included in this review concluded that graphic organizers are effective in improving student learning. The definition of improved student learning includes not only improved student performance as measured by classroom assessments but also teacher-observed behaviors such as time on task and engagement. A drawback that needs to be considered is classroom assessment, and teacher observations do not necessarily meet the criteria of valid and reliable. Due to the limited amount of information contained in some of the studies, it was not always possible to determine if the measures were valid and reliable.
The majority of SBR studies using graphic organizers that were included in this review involved the upper elementary (fourth and fifth) and middle level (sixth, seventh, and eighth) grades. A smaller number of studies have taken place in the lower elementary grades as well as the secondary level. Findings from the studies at all levels suggest that graphic organizers are an advantageous teaching and learning strategy at the upper elementary and middle level grades.

**Special Student Populations**

Students with learning disabilities are the main special population with which graphic organizer studies have been conducted. Middle school students have been the primary population studied. Most of the studies were designed to determine if the use of graphic organizers would improve reading comprehension for this student population in a variety of content areas. Students with learning disabilities typically have difficulty comprehending content area texts and often lack reading comprehension skills (Scanlon et al., 1992).

The seven SBR studies (Boyle & Weishaar, 1997; Doyle, 1999; Gallego et al., 1989; Gardill & Jitendra, 1999; Griffin et al., 1991; Scanlon et al., 1992; Sinatra et al., 1984) on the use of graphic organizers with students with learning disabilities included in this review indicated that graphic organizers were beneficial with this population of students. The studies (five quasi-experimental, two experimental) found graphic organizers to be effective strategies for helping such students comprehend content area material, organize information, and retain and recall content, as measured by posttests. Graphic organizers also have been found to be effective tools for helping these students make connections with existing schemas. Following is a review of these studies, including specific details and significant findings.

One SBR (quasi-experimental) study implemented the interactive semantic mapping (ISM) technique, with bilingual students with learning disabilities in the upper elementary grades using social studies texts, junior high students using science texts, and high school students using vocational texts (Scanlon et al., 1992). The numbers of students participating in the study were not indicated. ISM uses traditional semantic mapping procedures along with an interactive teaching strategy to help students with reading comprehension and the development of social skills (Scanlon et al., 1992). Pre- and posttest measures and a follow-up given a month later were used to assess student-learning gains. At the time of the posttest, students also produced written summaries of the content as another measure of the effectiveness of ISM in helping students understand and communicate the information they had studied. Both the posttest and follow-up scores indicated students who participated in the ISM strategy had greater recall and comprehension of content area concepts than students who participated in a contrast instructional condition-definition instruction. The contrast instructional condition-definition instruction has teachers teaching content-related definitions using “instructional methods that emphasize high student engagement through oral recitation, the correct and automatic pronunciation of each concept and its definition, and teacher monitoring and feedback” (Bos & Anders, 1992, p. 231). Follow-up scores also revealed that students exposed to ISM retained more information than students in the other group.
Similarly, the students’ written summaries verified that students who were a part of the ISM technique “demonstrated awareness of conceptual relationships by reflecting the hierarchy of concepts represented in their map . . . and “maintained content knowledge and expression skills” (Scanlon et al., 1992).

Similar findings were obtained by Gallego and others (1989) as they used interactive semantic mapping with students with learning disabilities ages 11 and 12 in the area of social studies. This quasi-experimental study involved six bilingual students. Among the major findings: students increased their declarative knowledge (specific facts and concepts) of social studies content and were able to demonstrate knowledge in how and when to use the learning strategy, as measured by videotaped classroom interactions, multiple-choice comprehension quizzes, and student-written summaries. An additional finding was that students performed at a higher social level through interaction with the teacher and other students.

Another SBR study, also in the social studies content area, was conducted with eight senior high students with learning disabilities as a part of a master’s research project (Doyle, 1999). This quasi-experimental study used two interventions for teaching information from the textbook. The first intervention entailed presenting different graphic organizers to the students and also having them develop their own graphic organizers. In the second intervention, which involved different parts of the text, the teacher presented the information through lecture and had the students copy notes that were written on the board. On completion of each of the chapters of text presented through the two interventions, the eight students participating in the study took a chapter textbook test. Students received higher scores on postinstruction tests when graphic organizers were used compared to when the more traditional lecture and note taking method of information presentation was used.

A quasi-experimental SBR study using semantic mapping as a prereading strategy for improving reading comprehension was undertaken with 27 students with learning disabilities in grades two through six, along with six students enrolled in ungraded special education classes (Sinatra et al., 1984). The students, who were referred to a university reading clinic, were exposed to one of two approaches: mapping readiness (episodic web, thematic or descriptive map, and classification map) or verbal readiness. Comprehension scores of students using the mapping readiness approach were higher than those of students using the verbal readiness approach. According to the teachers, when they constructed the maps along with the students, this helped the students focus on the organization of the reading selection, and the students could visually see how the ideas were connected.

Story mapping, another visual tool, was used to see if it was an effective instructional technique to use with six middle school students with learning disabilities in grades six through eight (Gardill & Jitendra, 1999). The quasi-experimental design involved students in a sequence of instruction with story maps. Initially teachers modeled the completion of the advanced story map. In the second or lead phase, students gradually took responsibility for completing story maps. Following was an independent practice phase where students read new stories and independently completed the story note sheets.
The final phase was generalization and maintenance. In this phase, students were assessed using a short story from a textbook reading program. Results of the reading comprehension assessment indicated an increase in story grammar and basal comprehension performance by all students.

Boyle & Weishaar (1997), in an experimental SBR study, examined the effects of cognitive organizers (expert-generated and student-generated on the reading comprehension of students with learning disabilities). The 39 students participating in the study were assigned to one of the two experimental groups (expert-generated or student-generated cognitive organizers) or to a control group. Students participating in the two experimental groups performed higher on measures of literal and inferential comprehension than did the students in the control group.

The final SBR study (experimental) reviewed examined the effect of graphic organizers on the acquisition and recall of science content by fifth- and sixth-grade students with learning disabilities (Griffin et al., 1991). Students were randomly assigned to a graphic-organizer condition or a no-graphic-organizer condition. Three special education classrooms with a total of 28 students participated in the study. Students in the graphic organizer condition did make gains from the pre- to the immediate posttest; however, the gains were not statistically significant.

Summary

Overall, the research demonstrates graphic organizers—story maps, interactive semantic maps, and other types—are an effective learning strategy for students with learning disabilities. Students demonstrated higher levels of comprehension and the ability to recall information when they had used a graphic organizer as a part of reading a content area textbook (e.g., science, social studies, etc).
CONCLUSIONS

The primary purpose of this literature review was to analyze the extant research on visual learning and graphic organizers to determine what the findings from SBR indicated about the effects these visual tools had on student achievement, critical thinking, comprehension, and writing. Inspiration Software, Inc. identified these areas as key to the assessment of its products’ effectiveness. The conclusions in this section are drawn to align with this purpose. After reviewing 29 SBR studies, researchers drew several conclusions about the effects of graphic organizers on student achievement, critical thinking (and thinking and learning skills as a whole), and reading comprehension and writing (literacy development).

Student Achievement

The benefits of graphic organizers across several content areas (science, social studies, mathematics, Spanish as a second language, vocabulary, reading, and writing), multiple grade levels (first through senior high school), and different student populations (regular education students and students with learning disabilities) have been verified in the 29 experimental and quasi-experimental SBR studies cited throughout this paper. All of the studies included in this review have shown that using graphic organizers led to improved student performance as measured by various forms of assessments (classroom-based, observation, textbook, and standardized). Graphic organizers also have been found to result in superior student performance when compared with more traditional forms of instruction (e.g., lecture, linear note taking, question/answering).

SBR supports the use of graphic organizers at the upper elementary (fourth and fifth) and middle level (sixth through eighth) grades (Alvermann & Boothby, 1986; Alvermann & Boothby, 1983; Armbruster et al., 1991; Berkowitz, 1986; Braselton & Decker, 1994; Brookbank et al., 1999; Bowman et al., 1998; Darch et al., 1986; Davis, 1994; DeWispelaere & Kossack, 1996; Gallego et al., 1989; Gardill & Jitendra, 1999; Gordon & Rennie, 1987; Griffin et al., 1995; Griffin et al., 1992; Guastello et al., 2000; Hawk, 1986; Reutzel, 1985; Ritchie & Volk, 2000; Scanlon et al., 1992; Simmons et al., 1988; Sinatra et al., 1984; Troyer, 1994; Willerman & Mac Harg, 1991).

Some SBR (Brookbank et al., 1999; Davis, 1994; Gallick-Jackson, 1997; Meyer, 1995; Sinatra et al., 1984) also exists to support the use of graphic organizers in the lower elementary grades (kindergarten through third). Positive results have been shown with secondary grade level (9th through 12th) students as well (Boyle & Weishaar, 1997; DeWispelaere & Kossack, 1996; Doyle, 1999; Scanlon et al., 1992).

For the special population of students with learning disabilities, graphic organizers have been used with success (Boyle & Weishaar, 1997; Doyle, 1999; Gallego et al., 1989; Gardill & Jitendra, 1999; Griffin et al., 1992; Scanlon et al., 1992; Sinatra et al., 1984). Students with learning disabilities typically have difficulty comprehending content area texts and lack reading comprehension skills (Scanlon et al., 1992). Graphic organizers have been found to be effective tools for helping these students organize information and
make connections with existing schemas. As a result, for the students with learning disabilities studied, comprehension and recall of information was enhanced.

**Critical Thinking**

The process of developing and using a graphic organizer has been shown to enhance students’ critical thinking or higher order thinking skills (Brookbank et al., 1999; DeWispelaere & Kossack, 1996).

In addition to developing critical thinking skills, graphic organizers have also been shown to help students with mathematical problem solving (Braselton & Decker, 1994). Graphic organizers have helped students retain and recall information (Bos & Anders, 1992; Ritchie & Volkl, 2000; Griffin et al., 1995). And, students have effectively used graphic organizers as an outlining tool (Doyle, 1999; Meyer, 1995). Doyle (1999) found students with learning disabilities obtained higher test scores on end of chapter tests if they used graphic organizers as study tools as compared to traditional linear note taking methods. Meyer (1995) concluded third grade students writing improved as a result of using graphic organizers to organize ideas.

As a tool to support students’ thinking and learning processes, the 29 research studies have shown that graphic organizers help students:

- brainstorm ideas.
- develop, organize, and communicate ideas.
- see connections, patterns, and relationships.
- assess and share prior knowledge.
- develop vocabulary.
- outline for writing process activities.
- highlight important ideas.
- classify or categorize concepts, ideas, and information.
- comprehend the events in a story or book.
- improve social interaction between students, and facilitate group work and collaboration among peers.
- guide review and study.
- improve reading comprehension skills and strategies.
- facilitate recall and retention.

**Reading Comprehension and Writing (Literacy Development)**

Graphic organizers have been found to improve students’ reading comprehension at all levels, first grade through high school (Berkowitz, 1986; Bowman et al., 1998; Brookbank et al., 1999; Davis, 1994; Darch et al., 1986; Gordon & Rennie, 1987; Reutzel, 1985; Sinatra et al., 1984; Troyer, 1994); in content area classes, for example, science and social studies (Alvermann & Boothby, 1986; Griffin et al., 1995; Guastello et al., 2000); and with students with learning disabilities (Gardill and Jitendra, 1999). A
limited amount of research has been conducted with students at the early elementary level—first and second grade (Brookbank et al., 1999; Sinatra et al., 1984).

Further support for graphic organizers was found in a report by the National Reading Panel (2000) titled *Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction*. NRP cited graphic and semantic organizers (including story maps) as one of seven categories of instruction that is the most effective in improving reading comprehension.

Evidence has also been found to indicate graphic organizers benefit elementary age students (second and third grade) in the writing process and improve their writing skills (Gallick-Jackson, 1997; Meyer, 1995).
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