



Graphic Organizers

A Report Prepared by
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Introduction

One way to help make a curriculum more supportive of students and teachers is to incorporate graphic organizers. Graphic organizers come in many varieties and have been widely researched for their effectiveness in improving learning outcomes for various students. The following five sections present a definition of graphic organizers, a sampling of different types and their applications, a discussion of the research evidence for their effectiveness, useful Web resources, and a list of referenced research articles. We have focused this overview on applications of graphic organizers to reading instruction, with the intention of later expanding the discussion into other subject areas.

Definition

A graphic organizer is a visual and graphic display that depicts the relationships between facts, terms, and or ideas within a learning task. Graphic organizers are also sometimes referred to as knowledge maps, concept maps, story maps, cognitive organizers, advance organizers, or concept diagrams.

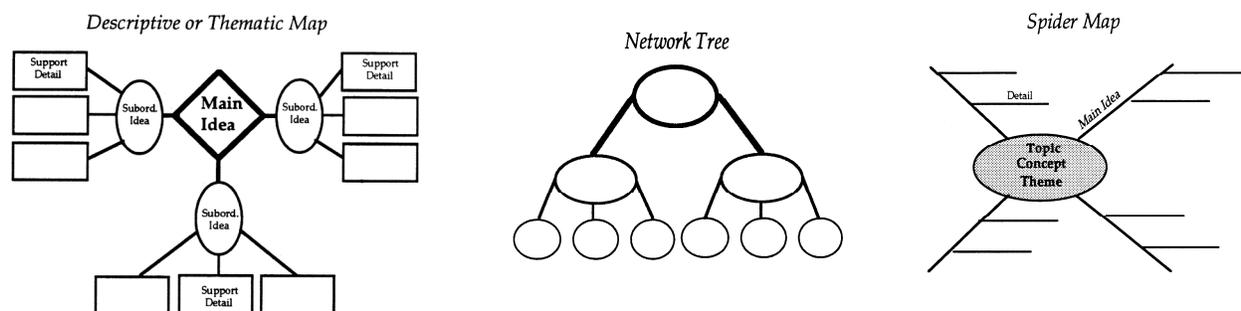
Types of Graphic Organizers

Graphic organizers come in many different forms, each one best suited to organizing a particular type of information. The following examples are merely a sampling of the different types and uses of graphic organizers.

A **Descriptive or Thematic Map** works well for mapping generic information, but particularly well for mapping hierarchical relationships.

Organizing a hierarchical set of information, reflecting superordinate or subordinate elements, is made easier by constructing a **Network Tree**.

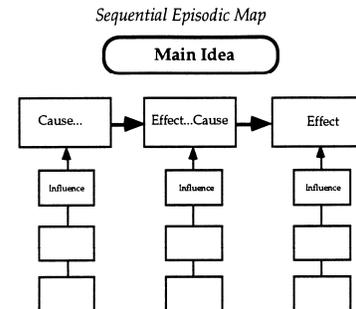
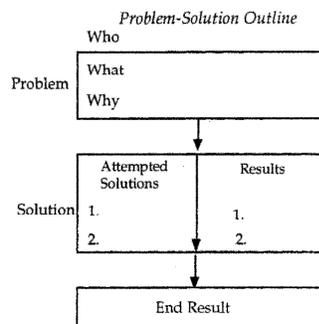
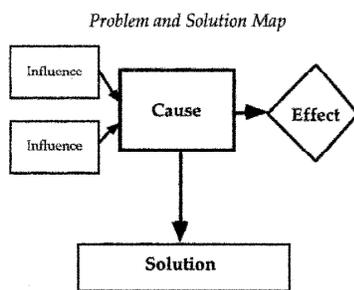
When the information relating to a main idea or theme does not fit into a hierarchy, a **Spider Map** can help with organization.



When information contains cause and effect problems and solutions, a **Problem and Solution Map** can be useful for organizing.

A **Problem-Solution Outline** helps students to compare different solutions to a problem.

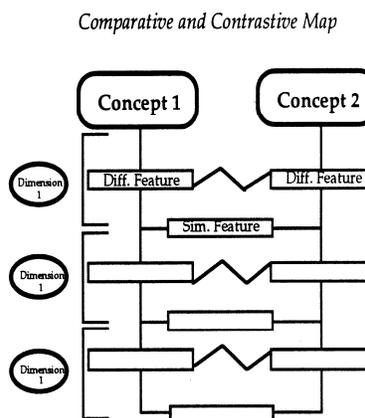
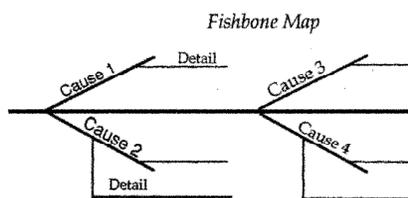
A **Sequential Episodic Map** is useful for mapping cause and effect.



When cause-effect relationships are complex and non-redundant a **Fishbone Map** may be particularly useful.

A **Comparative and Contrastive Map** can help students to compare and contrast two concepts according to their features.

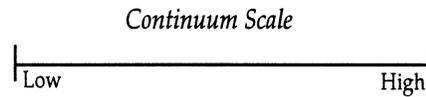
Another way to compare concepts' attributes is to construct a **Compare-Contrast Matrix**.



Compare-Contrast Matrix

Attribute 1		
Attribute 2		
Attribute 3		

Continuum Scale is effective for organizing information along a dimension such as less to more, low to high, and few to many.

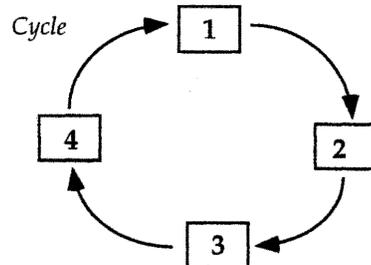
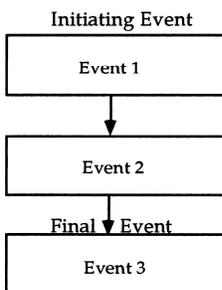


A **Series of Events Chain** can help students organize information according to various steps or stages.

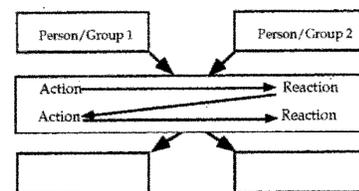
A **Cycle Map** is useful for organizing information that is circular or cyclical, with no absolute beginning or ending.

A **Human Interaction Outline** is effective for organizing events in terms of a chain of action and reaction (especially useful in social sciences and humanities).

Series of Events Chain



Human Interaction Outline



Applications Across Curriculum Areas

Graphic organizers have been applied across a range of curriculum subject areas. Although reading is by far the most well studied application, science, social studies, language arts, and math are additional content areas that are represented in the research base on graphic organizers. Operations such as mapping cause and effect, note taking, comparing and contrasting concepts, organizing problems and solutions, and relating information to main ideas or themes can be beneficial to many subject areas. The observed benefits in these subject areas go beyond those known to occur in reading comprehension (Bulgren, Schumaker, & Deshler, 1988; Darch, Carnine, & Kammenui, 1986; Herl, O'Neil, Chung, & Schacter, 1999; Willerman & Mac Harg, 1991).

Evidence for Effectiveness

There is solid evidence for the effectiveness of graphic organizers in facilitating learning. Ten of the 12 studies investigating effects of graphic organizer use on learning reviewed here reported some positive learning outcome. We focus this overview on two main areas: comprehension and vocabulary knowledge.

Comprehension

By far the most frequently investigated learning measure in the studies we reviewed is comprehension. Of 15 studies, 7 (Boyle & Weishaar, 1997; Bulgren et al., 1988; Darch et al., 1986; Gardill & Jitendra, 1999; Idol & Croll, 1987; Sinatra, Stahl-Gemake, & Berg, 1984; Willerman & Mac Harg, 1991) reported that graphic organizer use elevated comprehension. Comprehension measures included the Stanford Diagnostic Reading Test (Boyle & Weishaar, 1997), comprehension questions (Alvermann & Boothby, 1986; Boyle & Weishaar, 1997; Darch et al. 1986; Gardill & Jitendra, 1999; Idol & Croll, 1987; Sinatra et al, 1984), a concept acquisition test (Bulgren et al., 1988), teacher-made tests (Bulgren et al., 1988; Willerman & Mac Harg, 1991), written summaries (Gallego et al., 1989), and story grammar tests (Gardill & Jitendra, 1999). The reliability of these improvements in comprehension is further supported by Moore and Readence's (1984) metaanalysis. When looking across 23 different studies they found a small but consistent effect on comprehension.

Although 3 studies reported no effect of graphic organizer use on comprehension, these findings appear to be attributable to deficiencies in experimental design. Carnes, Lindbeck, & Griffin (1987) reported no effect of advance organizer use relative to non-advance organizer use on the comprehension of microcomputer physics tutorials. However, students in this study were not trained to use the advanced organizers. This same factor may account for the lack of effect in the Clements-Davis & Ley (1991) study, where high school students received no instruction on how to use the thematic pre-organizers that they were given to assist story reading. Alvermann and Boothby (1986) also failed to demonstrate an improvement in comprehension. In this case, the lack of improvement is quite likely due to a ceiling effect – as comprehension scores were quite high even before the intervention. Thus, weighing the collective evidence there still appears to be strong support for the ability of graphic organizers to improve reading comprehension.

Vocabulary Knowledge

Moore and Readence's (1984) meta-analysis suggests that gains in vocabulary knowledge following graphic organizer use may be even greater than gains in comprehension. The average effect size for the 23 studies reviewed was more than twice as large as that reported for comprehension. Thus, graphic organizers appear to be a very effective tool for improving vocabulary knowledge.

Factors Influencing Effectiveness

Research studies have established that successful learning outcomes in the areas described above are contingent on certain factors. Important variables include grade level, point of implementation, instructional context, and ease of implementation. We elaborate the influence of these variables here.

Grade Level

Successful learning outcomes have been demonstrated for students with (Anderson-Inman, Knox-Quinn, & Horney, 1996; Boyle & Weishaar, 1997; Bulgren et al., 1988; Gallego et al., 1989; Gardill & Jitendra, 1999; Idol & Croll, 1987; Newby, Caldwell, & Recht, 1989; Sinatra et al., 1984) and without (Alvermann & Boothby, 1986; Bulgren et al., 1988; Darch et al., 1986; Willerman & Harg, 1991) learning disabilities across a range of grade levels, including

elementary, junior high, and high school. However, on average the largest effects of graphic organizers on learning from text have been reported for University populations (Moore & Readence, 1984). There are consistent although more modest effects for elementary populations (Moore & Readence, 1984).

Point of Implementation

Graphic organizers may be introduced as advance organizers, before the learning task, or as post organizers, after encountering the learning material. A review of the research from 1980-1991 (Hudson, Lignugaris-Kraft, & Miller, 1993) concludes that visual displays can be successfully implemented at several phases of the instructional cycle. Indeed, positive outcomes have been reported when graphic organizers are used as both advance (Boyle & Weishaar, 1997; Gallego et al., 1989) and post organizers (Alvermann & Boothby, 1986; Boyle & Weishaar, 1997; Gardill & Jitendra, 1999; Idol & Croll, 1987; Newby et al., 1989; Sinatra et al., 1984; Willerman & Mac Harg, 1991).

However, the precise point of implementation does appear to influence the degree of graphic organizers' effectiveness. In their comprehensive review, Moore and Readence (1984) report that the point of implementation is a crucial factor in determining the magnitude of improvement in learning outcome. When graphic organizers were used as a pre-reading activity, average effect sizes were small. In contrast, graphic organizers used as a follow up to reading yielded somewhat large improvements in learning outcomes. Thus, efforts to improve learning outcomes may be more successful when graphic organizers are introduced after the learning material.

Instructional Context

In reviewing 11 years of research, Hudson et al. (1993) note that positive outcomes for curricular enhancements require the use of effective teaching practices. Merkley & Jefferies (2001) note that "It is important, however, that GO planning extend beyond construction of the visual to the deliberate consideration of the teacher's strategies...to accompany the visual." Thus, instructional context is another determinant of the effectiveness of graphic organizers for improving learning.

Without teacher instruction on how to use them, graphic organizers may not be effective learning tools (Carnes et al. 1987; Clements-Davis & Ley, 1991). Graphic organizers can successfully improve learning when there is a substantive instructional context such as explicit instruction incorporating teacher modeling (Boyle & Weishaar, 1997; Gardill & Jitendra, 1999; Idol & Croll, 1987; Willerman & Mac Harg, 1991) and independent practice with feedback (Boyle & Weishaar, 1997; Gardill & Jitendra, 1999; Idol & Croll, 1987), strategy instruction (Anderson-Inman et al., 1996; Boyle & Weishaar, 1997; Darch et al., 1986; Scanlon, Deshler, & Schumaker, 1996), story mapping (Gardill & Jitendra, 1999; Idol & Croll, 1987), semantic mapping (Gallego et al., 1989), and concept teaching routines (Bulgren et al., 1988). Most successful interventions minimally include a teacher introduction describing the purpose of the graphic organizer and setting the reading purpose.

In the absence of systematic study of the role of instructional context, it is difficult to identify with confidence specific aspects that are tied to success. However, in our review an interactive/collaborative approach involving teacher modeling, student-teacher discussion, and

practice with feedback appeared to be consistently correlated with learning improvement (Alvermann & Boothby, 1986; Bulgren et al, 1988; Gardill & Jitendra, 1999; Idol & Croll, 1987; Scanlon et al., 1996). Thus, contexts that provide opportunity for student input and interaction with the teacher and/or one another (Darch et al., 1986; Gallego et al., 1989) may be especially effective.

Also useful are Merkley and Jefferies' (2001) specific suggestions for teaching with graphic organizers. Their guidelines include: verbalizing relationships between the concepts represented within the organizer, providing opportunities for student input, connecting new information to past learning, making reference to upcoming text, and reinforcing decoding and structural analysis.

A relatively new area of research is the investigation of computer-based methods for presenting graphic organizer instruction. Herl et al. (1999) tested the effectiveness of two, computer-based knowledge mapping systems in a population of middle and high school students. Students either worked individually using an artificial Web space to augment and revise knowledge maps or networked with one another across computers to collaboratively construct maps. Knowledge mapping scores (determined by comparison to expert maps) were significantly improved for individuals working individually to elaborate maps, but not for students involved in collaborative construction. These findings indicate that a computer-based system can be successfully used to instruct students on how to develop concept maps. They also suggest that web searching methods may improve students' abilities to develop sophisticated maps. Student collaborative approaches, however, may be less effective.

Carnes et al. (1987) constructed computerized advanced organizers to help introduce high school physics students to microcomputer physics tutorials but were unable to establish a significant improvement in learning rate, retention, or performance on a teacher made achievement test. However, the lack of effect is likely attributable to the absence of teacher introduction or training with the organizers.

Findings by Anderson-Inman et al. (1996) found substantial variability in the adoption of computer-based graphic organizer study strategies. Some students became quite skilled and independent with these strategies, while others developed only basic skills and remained reluctant in their use. Their finding that differences in adoption level were correlated with reading test and intelligence scores suggests that it may be possible to predict levels of user proficiency.

Successful learning outcomes can be obtained in a variety of classroom settings, including special education classrooms (Anderson-Inman et al., 1996; Boyle & Weishaar, 1999; Gardill & Jitendra, 1999) mainstream classrooms (Alvermann & Boothby, 1986; Bulgren et al., 1988; Darch et al., 1986; Willerman & Mac Harg, 1991) and one-on-one instruction (Idol & Croll, 1987; Newby et al., 1989; Sinatra et al., 1984). However, the relative ease of implementation is an important determinant of this success (Novak, 1980). Some instructional contexts that have been successful in research studies are unfortunately difficult for teachers and or students to implement. For example, Scanlon et al. (1996) developed (collaboratively with teachers) a 5-step strategy and substrategy for helping students in academically diverse classes to process

information and put it into a graphic organizer for studying and/or writing. Teachers in the study implemented the prescribed teaching behaviors to much less of a degree than they had promised and expressed dissatisfaction with the lack of fit with their regular teaching routine. Students trained with the strategy performed better than controls on a strategy performance test, but to only a modest degree. They were at best ambivalent about the utility of the strategy for improving learning. Moore and Readence (1984) make similar observations in their meta-analysis, noting frequent reports that students were unable to appreciate the value of graphic organizers to learning and felt that these tools were out of place in the current instructional context. To draw more solid conclusions about the best ways to implement graphic organizers, more systematic investigations of the role of instructional context are needed.

URL

The Graphic Organizer

<http://www.graphic.org/index.html>

This site is a rich resource for learning about graphic organizers, offering links, lists of references and books about graphic organizers, information about using graphic organizers for writing, guidelines for designing graphic organizers and assisting students in designing them, and samples of student work with graphic organizers.

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