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Graphic Organizers

Tools to Promote Critical and Creative Thinking

Graphic organizers provide teachers with tools to help students on the road to higher achievement. Graphic organizers that target critical and creative thinking verbs are vehicles to help develop students' cognitive abilities and provide formats for students to process their thinking about content. Graphic organizer formats also allow teachers to diagnose where students' thinking has gone awry. Teachers can pinpoint areas in which students' thinking is weak, illogical, or unclear. The structure and language of the organizer allows teachers to be able to coach students and move them beyond where thinking has fallen apart. Graphic organizers provide new language that facilitates classroom communication, as well as deepen understanding of the content that teachers work to transmit.

For certain students, the use of graphic organizers is particularly beneficial:

- For students who easily fall victim to faulty reasoning, they are an aid to the thinking process.
- For students who have difficulty expressing their thoughts, they provide a format for expression.
- For students who have difficulty processing information, they provide a structure within which to state content and support for ideas.
- For students who are visual learners, they provide a visual aid.
- For students who ramble, they help focus the response.
- For students who are English Language Learners, they can enable the expression of depth of thought through the use of limited written responses.

EVIDENCE SUPPORTING GRAPHIC ORGANIZERS

Many studies have established the value of graphic organizers as cognitive tools. Stiggins (quoted in Gregory & Kuzmich, 2004, p. 142), for example, states that "When graphic organizers are used, students show increases in retention and comprehension, and they demonstrate higher levels of achievement on content-based assessments."

A number of studies have focused on Hyerle's (2004) Thinking Maps, which target eight thinking skills. Each map includes a visual structure with shared language and procedures. Studies using his eight maps have been conducted in a variety of schools and content areas, and they indicate many positive outcomes, including an increase in student achievement in all content areas.

The effectiveness of graphic organizers is also supported in the meta-analysis conducted by Marzano, Pickering, and Pollock (2001) in which they identify nine ways to increase student achievement. I discuss these nine strategies in the following list, which includes the percentage rates of improved student achievement according to the study. The list also contains the names of graphic organizers presented in this book that can be used as instructional strategies to target each area.

1. Recognizing similarities and differences, using metaphors and analogies: Students trained in these skills showed a 45 percent gain over students who were not. The ability to recognize similarities and differences is crucial to connecting new information with known information. In Chapter 9, the Rose-Colored Glasses graphic organizer enables students to draw analogies by relating similar content characteristics and attributes to an animal, place, object, and/or themselves. In Chapter 4, the Paint Jars (inference) graphic organizer can be used to find differences. In Chapter 5, the graphic organizer called the Framed Puzzle can be used to not only recognize differences but also analyze them.

2. Summarizing and note taking: Trained students showed a 37 percent gain. Most of the graphic organizers in this book can be used as summarization tools. Students use the graphic organizers to organize their notes by making judgments (Chapter 7) or perhaps prioritizing (Chapter 6) them.

3. Reinforcing effort and providing recognition: Trained students showed a gain of 29 percent. Teachers can address this category by using strategies that give specific feedback, which includes recognition for effort. Every graphic organizer in the following chapters has accompanying feedback tools. These tools are not meant to be used only as grading mechanisms. They are designed to give ongoing direction and feedback, so that students have guiding tools for processing information and a system in place for refining their responses. In this way, students are recognized not just for complete, correct answers but also for partial answers.

4. Homework and practice: Trained students showed a 28 percent gain. Any of the graphic organizers in Chapters 3–11 can be used as a homework assignment to review content or in the classroom as a way to rehearse or practice new learning.

5. Nonlinguistic representations: Trained students showed a 27 percent gain. This category addresses the importance of using strategies that use pictures, diagrams, and organizers. All of the graphic organizers in this book target critical and creative thinking, and can be used to differentiate instruction.

6. Cooperative learning: Trained students showed a 27 percent gain. As you read about the graphic organizers in the following chapters, the idea of flexible grouping (students working with different groups of students periodically) is promoted and encouraged. We cannot create cooperative learning groups all of the time, and we know that for some types of learners, such as introverts, this type of learning can feel exhausting. Most students, however, are very social. They like to work with their peers. This type of learning is motivational and engaging. Many students need help moving their thinking beyond a literal level and the teacher is

not always available to help out. Cooperative learning can provide a management system that enables students to help one another by working on the graphic organizers together.

7. Setting objectives and providing feedback: Trained students showed 23 percent gains. The language and structure provided in the graphic organizers in this book provide clarity as to how the teacher wants the students to think about what they know. The use of cognitive graphic organizers makes the objectives clearer and also serves to provide guided feedback. Brain research also indicates that feedback needs to be specific for it to be most effective. Graphic organizers presented in this book use procedural language, structured formats, and rating scales and rubrics that provide teachers with the direction necessary to give quality feedback.

8. Generating and testing hypotheses: Trained students showed a gain of 23 percent. By asking students to come up with a hypothesis and then support it, students are encouraged to use both critical and creative thinking skills. Many of the graphic organizers in this book serve as ways to test hypotheses. In Chapter 7, students are asked to make a belief statement and then justify it in the "judge" graphic organizer. In Chapter 3, students are asked to state an "assumption" and then support their statement. In Chapter 4, students are asked to make an "inference" statement. They then reflect on facts and prior knowledge supporting this inference and draw a conclusion.

9. Using questions, cues, and advance organizers: Trained students showed a 22 percent gain. Throughout this book, the importance of word cues and shared language is discussed. High-level questions promote deep thinking and long-lasting learning, but word cues help students know what we are looking for. By paying attention to both the content and the verb in prompts, students learn just how important word cues are.

THE USE OF VERBS

There is wide consensus that graphic organizers are useful tools to promote critical thinking and boost student achievement. But why provide graphic organizers that focus on verbs?

The use of specific verbs is considered a cognitive organizer because it directs students to think about content critically and creatively, as well as in an organized way. Obviously, students could use an organizer like an outline to help with their thinking. The organizers in Chapters 3–11, however, have the added advantage of focusing students on the action suggested by the verb. For example, some students have difficulty prioritizing. If they are asked to decide which event had the greatest impact in the presidential election, students can apply the four-step process they learned by using the Prioritizer graphic organizer. The knowledge of *how* to prioritize, along with the content knowledge, helps students to make logical, informed responses with precision.

Graphic organizers that use verbs are also useful to differentiate teaching because they help to pinpoint when and where students get stuck. Is it a lack of content information? Does the student understand the question? Can the student express an answer? I examine each of these possibilities in turn.

1. *Does the student lack content information?* If the student cannot fill out the graphic organizer or has only partial responses, try changing the verb in the prompt. Simplify the verb to the knowledge or comprehension level and see if the student can give you at least a partial answer. In this way, you can glean whether the student has a minimal understanding of the information. She may need more practice and review of the content information before she is able to be successful with a high-level thinking graphic organizer.

2. *Does the student understand what the question is asking her to do?* If, after simplifying the verb, the student gives you quite a lot of information but still has trouble with the graphic organizer, it may indicate that the student is having difficulty responding to the verb in the question or prompt. This means the student needs help understanding how to process the verb. Once this happens, the students will know what the question is asking. For instance, if the teacher asks students to make an inference based on an article they read on pollution, then this assignment assumes students can read and understand the article as well as know how to make an inference. If the student knows information but is unable to make inferences, then the teacher can use the Paint Jars graphic organizer to demonstrate how to make inferences. Students can continue to use the graphic organizer until they no longer need to write out the process.

3. *Can the student express her answer so that it is understood?* Some students do not have the writing skills or expressive language to write essays and reports. A major advantage of using these graphic organizers is that they require limited written responses. This is an effective tool for students who have difficulty writing or are English Language Learners. They may have a good grasp of the content information, but are not successful at conveying their knowledge when asked to make written responses. According to Reiss (2005 p. 75), "The graphic organizer allows ELL students to give a maximum amount of information with only a minimum amount of language." In short, the graphic organizer allows the teacher to assess to what degree the student actually knows the content information without having language problems interfere with communication.

WHY THESE NINE VERBS?

You might wonder how I decided to focus on the specific verbs described in this book. It's clear that the teaching of thinking and reasoning is critical to student achievement (Futrell, 1987; National Education Goals Panel, 1991; National Science Board Commission, 1983). It's not always clear, however, how thinking and reasoning should be taught. To answer this question, Marzano and Pollack (2001) analyzed an exhaustive study by Kendall and Marzano (2000), who looked at national standards across content areas to identify what skills were used in multiple standards. Marzano and Pollack identified the following six thinking and reasoning skills that come up again and again:

1. Identification of similarities and differences

2. Problem solving and troubleshooting

3. Argumentation

4. Decision making

5. Hypothesis testing and scientific inquiry

6. Use of logic and reasoning

The verbs used in Chapters 3–11 of this book are linked to the six thinking and reasoning skills identified by Kendall and Marzano (2000). These include five critical thinking skills—assuming, inferring, analyzing, prioritizing, and judging, and four creative thinking skills—brainstorming, connecting, creating, and elaborating.

For Skill 1, identification of similarities and differences, teachers can use the "connect" graphic organizer to help students identify similarities. Or, the "inference" graphic organizer encourages students to look for similarities and differences that aren't immediately apparent.

When teachers focus on problem solving and troubleshooting (Skill 2), they can use the "brainstorming" graphic organizer to help students generate ideas, the "elaboration" graphic organizer to help students develop their ideas, and the "analyze" graphic organizer to help students differentiate between the parts of problems.

For argumentation and decision making (Skills 3 and 4), the "assumption" graphic organizer can help students sort out points of view and perspectives, as well as identify important decisions that need to be made.

For hypothesis testing and scientific inquiry (Skill 5), brainstorming helps get the processes going and the "create" graphic organizer helps bring the idea to fruition.

Finally, for tasks involving logic and reasoning (Skill 6), the "analyze" and "judge" graphic organizers are useful.

The target verbs in each graphic organizer were also chosen because they are commonly used in the classroom but are not readily available in a graphic organizer format on the Internet or in other books. Over many years, I've asked my university students, who are teachers, to identify the verbs they focus on in their classrooms. Some teachers said they expected their students to make inferences, but they didn't really have a good way to explain how to make an inference. Some teachers said their students made assumptions, which contributed to their reaching erroneous conclusions. These teachers wanted a way to help students distinguish between new information and prior assumptions that interfered with new learning. High school teachers could not believe their students still could not write a good analysis. Elementary teachers wanted to help students make meaningful judgments. Teachers at all grade levels said their students needed help prioritizing information. The nine verbs emerged as a response to the needs of these practitioners. Once the verbs were identified, pilot graphic organizers were field-tested across grade levels and content areas.

PURPOSES OF GRAPHIC ORGANIZERS

Graphic organizers can and should be used in a purposeful way. If teachers consider the objectives of the lesson and the strategies to reach those objectives, then they can decide which graphic organizer to use with all, some, or individual students. In Figure 1.1, six main purposes of graphic organizers are listed. These are discussed below.

1. Many practitioners have experienced the usefulness of graphic organizers, both in and outside of the classroom. As we've seen, the overriding reason for teachers to use graphic organizers is to **improve student achievement**, but there are at least five other reasons to incorporate them into classroom practice.

2. We use graphic organizers to help students **make sense of information**. Merkley and Jefferies (2001) state the benefits of using graphic organizers as (1) enabling students to verbalize relationships, (2) allowing students to connect information from past learning to new learning, (3) allowing students to anticipate new learning by previewing information, and (4) allowing students the ability to decode and apply structural analysis in reading. Making sense of information encompasses all of these things and more.

3. This leads us to another significant reason why teachers should use graphic organizers; they help students **chunk information**. In the Information Age, information overload is a problem. It's critical for students to be able to sort through expanses of material accrued through research. Graphic organizers help students sort through information, prioritize it, sequence it, evaluate it, and build on it. Without the ability to structure information, the management and retrieval of information can be overwhelming.

4. A fourth reason for using graphic organizers is to **promote depth of learning**. In 1997, Caine and Caine wrote, "Deep meaning refers to whatever drives us and governs our sense of purpose" (quoted in Howard & Fogarty, 2003, p. 190). If students don't know what the learning means, or why it is relevant, then they will have little drive to think about it. Deep understanding has to do with understanding information and being able to apply it in context. This context may be a novel situation where the learning goes beyond the application of regurgitated information.

5. Graphic organizers also help us to **construct mental models** from which we can organize and make sense of information. These models provide a framework for metacognitive learning. Hyerle (2004, p. 23) says, "When students repeatedly associate a concrete visual pattern with an abstract thought process, they learn patterns for what thinking looks like." Cognitive graphic organizers lay out specific procedures that delineate thought processes, so that students know what the teacher is expecting for a response. Students practice these processes in a variety of contexts and, after time, are able to use them independently of the graphic organizers. They can actually visualize the processes and formats. For example, students can visualize the "prioritize" graphic organizer and know there are four steps to prioritize. First, list the ideas; second, narrow the ideas to four; third, order the ideas in terms of greatest importance; and fourth, give reasons for their top priority. Visual learners will

Figure 1.1   Purposes of Graphic Organizers

Purposes of Graphic Organizers
1. Improve student achievement.
2. Make sense of information.
3. Chunk information.
4. Promote depth of learning.
5. Construct mental models.
6. Foster motivation.

associate the process with the graphic organizer design. For example, they will visualize the "prioritize" machine on the graphic organizer and then remember the steps to prioritizing. Metacognition takes place as a result of students making mental models, practicing in different contexts, receiving specific feedback, and transferring the formats to other situations on their own. Perkins, in 1995, said, "Transfer occurs when a person applies knowledge or skills acquired from some earlier context in a new context" (quoted in Howard & Fogarty, 2003, p. 164). By promoting cognitive graphic organizers across content, students are able to see the generalized applications of these tools and their personal relevance to their own world.

6. For most students, graphic organizers are fun to use and provide variety; thus, they **foster motivation**. This book looks at nine different graphic organizers in detail. I hope you will not use the same one over and over again. Tweak your verbs and provide students with choices. Most often, you can reach the same objective by asking a critical thinking question as with a creative thinking question. So, mix up the verbs and let students choose which graphic organizer they want to use to create a response.

Graphic organizers also lend themselves to small group learning. Students work together to share ideas, discuss viewpoints, and come up with a group response for an organizer. Graphic organizers can also be tailored to fit with students' individual learning styles. Remember, these are enabling tools. Whereas most students will find the graphic organizers useful and motivational, there will be some students who do not like them. If the student is able to process the information without the guide, then by all means let her answer questions in the style that best suits her.

The graphic organizers described in the following chapters target high-level thinking, but it isn't high-level thinking alone that will help students attain depth in learning. It's the level of content, along with the thinking process, that achieves this depth. Therefore, teachers need to supply the appropriate content prompt that promotes high-level thinking.

CONTENT APPLICATIONS OF GRAPHIC ORGANIZERS

Graphic Organizers and Reading

Graphic organizers are effective strategies to promote reading comprehension. The National Reading Panel (2000) cited graphic and semantic organizers as one type of instructional strategy that is effective in the improvement of reading instruction. Findings from seven research reports concurred with this conclusion (Berkowitz, 1986; Bowman et al., 1998; Darch et al., 1986; Davis, 1994; Gordon & Rennie, 1987; Reutzel, 1985; Troyer, 1994, all cited by the Institute of Advancement of Research in Education, 2003). Of twelve studies reviewed by Strangman et al. (2003) at the National Center on Accessing the General Curriculum, nine studies found that graphic organizers increased reading comprehension.

The graphic organizers presented in this book will work well before, during, and after reading. Pre-reading activities can be used as a hook to engage the reader. Teachers might ask students what assumptions can be made about the book by reading the title or the chapter titles. Or, students might be challenged to infer the author's purpose in writing a book after they have read the author's biography.

The graphic organizers can also be used during reading to check ongoing comprehension. For example, part way through the story, students might be asked to make inferences and judgments regarding the character's actions in the story so far. They could be asked to elaborate on the character's relationships with the other characters in the story.

Finally, graphic organizers can be used as a summative activity to assess comprehension after students finish reading. Students might be asked to create a gift for the main character or analyze the actions of the antagonist in the story from the protagonist's point of view.

Graphic organizers can also be used to review vocabulary in various content areas. Students gain facility with new words when they use the Wheel of Words (elaboration) or Rose-Colored Glasses (connect) graphic organizers. Both of these organizers focus on creativity and therefore promote a more playful approach to learning vocabulary, which is far more effective than rote memorization.

Graphic Organizers and Writing

Graphic organizers are great tools to help students improve their writing. In 1999, 84 percent of fourth graders at Brookshire Elementary School passed the FCAT (Florida Comprehensive Assessment Test) in writing. After receiving training in Hyerle's Thinking Maps, the number of students who passed the FCAT writing section soared to 97 percent within one year (Hyerle, 2004). For many years now, teachers have been using graphic tools as pre-writing activities and seeing great results. For example, webbing has been used as a pre-writing activity with expository, persuasive, and narrative writing. A more conventional graphic organizer is an outline, which also helps students organize their thinking. A great computer program called Inspiration uses both webbing and outlining. This computer program takes brainstormed ideas and reformats them in outline form. Whether students have difficulty generating ideas, using elaborative language, or organizing their thoughts on paper, critical and creative thinking graphic organizers can help them develop fluency and provide organizational structures that will enable them to become more effective writers.

Graphic Organizers and Math, Science, and Social Studies

Critical thinking organizers can help students improve math skills by analyzing and judging their answers and reflecting on assumptions. Graphic organizers can be used to review information and review for a test or quiz. According to one study by Dickson, Simmons, and Kame'enui (1995), students who were taught how to use graphic organizers for test preparation retained significantly more information than did other students (cited in Kenney, Hancewicz, Heuer, Metsisto, & Tuttle, 2005). Because graphic organizers can also be a motivational tool, creative thinking graphic organizers, such as the Rose-Colored Glasses (connect) graphic organizer, can give students a fun way to learn or practice math vocabulary. For example, a teacher could prompt students to think of ways that a drawing of a trapezoid is like a drawing of a book. Student responses might be that they both have four sides, they both have four corners, they both come in many sizes, they both can be drawn three dimensionally, and so on.

In both science and social studies, students can use graphic organizers to take an issue and make assumptions and inferences. They can analyze information, prioritize it, and judge it. They can brainstorm ideas related to the issue, look at the flexibility of those ideas, and make connections to things they know. Finally, they can create a solution to resolve the issue and they can elaborate on it.

SOME CAVEATS AND CLARIFICATIONS

Graphic organizers are most often not the end product of a lesson. They may be used as tools to process thoughts before individuals join a group or to guide a group discussion. This process can improve a writing piece or written response, for instance, or be used to analyze and evaluate ideas before students use them in a product. In these situations, the organizers would rarely be assessed. The rating scale and rubrics that are included in Chapters 3–11, however, can still be used to provide valuable feedback. When a graphic organizer is the end product of a lesson or the follow-up for a homework assignment, teachers may grade the graphic organizer itself.

Once the verb processes are internalized, some students stop using the graphic organizers and just write the steps out on paper. Other students begin to visualize the process in their heads and do not feel the need to fill in a graphic organizer or even process their thoughts in writing. This is particularly important: We actually want students to wean themselves off graphic organizers and internalize the thinking processes that they foster. The goal is to have students become independent of the graphic organizer yet able to engage in the high-level critical and creative thinking skills that the organizers are intended to facilitate.

Not all lessons warrant using a graphic organizer. A graphic organizer is useful when there is a lot of information to sort through or when the information is at a complex level for the student. There is no need, for example, to have students fill out an "assume" graphic organizer (Chapter 3) when we are asking them to make a simple assumption. Similarly, graphic organizers are often helpful as aids to memory; but if the student does not really have to remember the information on a particular topic and can just Google it, then a graphic organizer is unnecessary. The graphic organizer is there to help students make meaning. It should never be used as busywork.

The graphic organizers described in Chapter 3–11 are not visually complex, and this is intentional. They delineate simple structures and processes so that all students can use them easily. But they also allow for advanced levels of content to be processed through their visual frameworks. They allow students to construct mental models that organize information. The formats facilitate both deductive and inductive reasoning and a variety of creative thinking processes. They are designed to be flexible tools or working templates. They are not meant to be prepackaged worksheets for which teachers verbalize scripted language and students fill in the blanks. Rather, they are meant to be dynamic models that can be adjusted according to your students' needs.

☞ KEY POINTS TO REMEMBER ABOUT GRAPHIC ORGANIZERS

1. Graphic organizers that target critical and creative thinking verbs are vehicles to help develop students' cognitive abilities and provide formats for students to process their thinking about content.

2. A graphic organizer that focuses on a specific verb is considered a cognitive organizer, because the organizer directs students to think about content critically, creatively, and in an organized way.

3. Cognitive graphic organizers provide new language that facilitates classroom communication, as well as deepen understanding of the content.

4. The overriding reasons for teachers to use graphic organizers are to increase student achievement, make sense of information, chunk information, promote depth of learning, construct mental models, and foster motivation.

5. Graphic organizer formats allow teachers to diagnose where students' thinking has gone awry.

6. Graphic organizers are most often not the end product of a lesson.

7. Graphic organizers should never be used as busywork.

? PAUSE FOR REFLECTION AND DISCUSSION

1. Compare and contrast graphic organizers that target critical and creative thinking processes with other types of graphic organizers.

2. Analyze the evidence that suggests the use of graphic organizers increases student achievement.

3. How can high-level thinking graphic organizers be used in the classroom? Prioritize your ideas in terms of their applicability to your classroom.

4. What is the relationship between graphic organizers and high-level thinking?

5. Judge whether you believe this statement to be true: Graphic organizers that delineate critical and creative thinking skills provide flexible formats for student responses.