Introducing Text Structures in Science Writing

Language Arts Standard VIII:
Students write daily to communicate effectively for a variety of purposes and audiences.

Objective 1:
Prepare to write by gathering and organizing information and ideas (prewriting).

Objective 6:
Write in different forms and genres.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Language Arts Standard VIII

Objectives 1 & 6

Connections

Background Information

Reading and writing are essential skills in science. This activity introduces students to the idea that science writing is organized in identifiable patterns called *text structures*. Understanding and using these different text structures help refine students' abilities to both read and write in science. The following five patterns are commonly found in science writing:

Description	Cause and Effect
Sequence	Problem Solution
Compare and Contrast	

A close reading of the Science Core Curriculum Standards, Objectives, and indicators suggests when writing might be used as part of science instruction. Verbs such as "describe," "compare," and "explain" signal that writing is an appropriate activity for that objective. That is not to say writing should be the only activity. Inquiry experiences and other hands-on science activities should be the center of science instruction. Writing is a good way to help students clarify their thinking, unite the big ideas in an objective, and to assess learning.

Because this lesson focuses on writing skills, it may actually be best taught in the language arts block. Writing is the perfect way to integrate science and language arts. Science gives students something—topics—to write about. Writing helps solidify understanding in science.

Invitation to Learn

Show students the *Text Structure Sample Sentence Strips* (p. 3-10), then post them on a chart or the board. Explain that science writing is often *expository writing*—writing that explains information and ideas—and that it is organized in different patterns called text structures. Show them the *Text Structure Word Cards* (p. 3-13). Have students read the *Text Structure Sample Sentence Strips* and match them with the *Text Structure Word Cards*.

This activity may be done with the whole class or in a small group setting.

TEXT STRUCTURE	EXAMPLE
DESCRIPTION	Golden Eagles are powerful raptors with large dark brown bodies and small heads with golden crowns.
SEQUENCE	First Golden Eagles soar high along ridges near their nests. They search for prey. When a meal is spotted, they attack in a long swoop.
COMPARE AND CONTRAST	Golden Eagles are apt to hunt for prey while Bald Eagles are more likely to take an easy meal.
CAUSE AND EFFECT	So many Bald Eagles were killed by pesticides and illegal hunting that they were in danger of becoming extinct.
PROBLEM AND SOLUTION	When a raptor species declines, scientists take wild bird eggs to raise in captivity and increase the number of birds.

Instructional Procedures

Materials

- ❑ *Text Structure Sample Sentence Strips*
- ❑ *Text Structure Word Cards*
- ❑ Science text materials such as textbooks, trade books, and magazine articles
- ❑ *Text Structure Samples*
- ❑ *Text Structure Definition* posters
- ❑ *Text Structure Graphic Organizer* posters

These procedures use direct instruction to explicitly teach students different science text structures. The same general process is used for teaching each text structure. Ideally, you should introduce and model each text structure separately. Next, give repeated practice in identifying the structure and then continue to reinforce it as it is encountered in science texts. When the students are proficient at identifying and understanding the organization of the structure, teach them to use it in their own science writing. Three writing activities that use specific text structures are included in this handbook: *Using Description to Write in Science* (p. 3-27), *Using Compare and Contrast to Write in Science* (p. 3-35), and *Using Cause and Effect to Write in Science* (p. 3-40).

1. Select a short passage of science writing that exhibits the kind of text structure you want to teach. The writing may be from a science text you use, a science trade book, a magazine article, or a piece of student writing. *Text Structure Samples* that go with the fifth grade Science Core are included on p. 3-14. Representative trade books are listed in *Additional Resources*.
2. Provide students with copies of the text you are going to read. This may be a textbook, a set of books for a small reading group, a student news magazine, a photocopy of a science article, or an overhead transparency of a short text.
3. Tell students that you want them to follow along as you read a piece of science writing. Explain that you will think out loud as you read it. Share your thoughts about the things you notice about the structure of the writing. Point out words and phrases that signal how the passage is organized. You may want to use a second piece of writing with the same text structure and have students share their thinking as you read and look for clues about how it is organized.
4. Show students a *Text Structure Definitions* poster (p. 3-17) and a *Text Structure Graphic Organizers* (p. 3-22) for text structure. Display the poster and graphic organizer. Or you may create your own definition of the text structure with your class and display it.
5. Reread the passage with the class. Look for the features of the particular text structure. Have students use highlighters or sticky notes to mark text features. The following chart summarizes the main features of the text structures.

TEXT STRUCTURE	FEATURES OF THE TEXT STRUCTURE
DESCRIPTION	Main idea, unique features, supporting ideas, examples.
SEQUENCE	Lists in order a series of events, steps in a process.
COMPARE AND CONTRAST	Lists and explains similarities and differences of two ideas.
CAUSE AND EFFECT	Explains causes or reasons and the results or effects.
PROBLEM AND SOLUTION	States a problem and possible solutions or answers.

6. Have students look for words or phrases that help signal what kind of text structure a passage is. These are often transition words that lead from one sentence or idea to the next. Have students mark the words with a highlighter or sticky note. Make a class list of these signal phrases. The chart below summarizes the signal words and phrases typical of each text structure.

TEXT STRUCTURE	KEY WORDS FOUND IN THE TEXT STRUCTURE
DESCRIPTION	for example, involves, can be defined, for instance, on, over, next to, also, within
SEQUENCE	to begin with, first, second, in addition, next, then, last, finally, another, also, earlier, later
COMPARE AND CONTRAST	different from, same as, alike, like, similar to, unlike, as well as, yet, either…or, not only…but also, although, most, however, on the other hand, opposite, opposed to, while
CAUSE AND EFFECT	because, so that, thus, unless, therefore, since, in order to, as a result of, this led to, then, reasons for, then…so, for this reason, consequently, an explanation for
PROBLEM AND SOLUTION	problem is, a solution is, solved by, alternative, possible answer, therefore, conclusion, evidence is, a reason for

7. Refer to the graphic organizer for the text structure you are teaching. Together with the class, separate the parts of the text and write them in the graphic organizer. It might be drawn on the board, chart paper, or on an overhead transparency. Display the graphic organizer for the class to refer to.
8. Have students practice looking for other examples of the text structure in their science reading.
9. Repeat the process with other text structures throughout the year.

Possible Extensions/Adaptations/Integration

- Teach the science text structures in small reading groups for more individualized instruction and practice.
- Post *Text Structure Definition* posters and/or *Text Structure Graphic Organizer* posters on a bulletin board for reminders and easy reference.
- Use the text structures for other informational reading and writing, for example, in social studies.
- Show samples of student work that are examples of different text structures.
- Coordinate instruction with special education teachers to reinforce ideas taught.

Assessment Suggestions

- Use informal assessment to check for understanding in reading discussions. Reteach in small guided-reading groups as necessary. Give students examples of several different text structures and have them identify the text structures.

Additional Resources

Teacher Resources on Nonfiction Writing

Books

6+1 Traits of Writing: The Complete Guide (Grades 3 and Up), by Ruth Culham (Chapter 3, Organization-Herding Cats, p. 68-99); ISBN 0-439-28038-9

Guiding Readers and Writers (Grades 3-6): Teaching Comprehension, Genre, and Content Literacy, by Irene C. Fountas and Gay Su Pinnell (2001); ISBN 0-325-00310-6

Nonfiction Matters: Reading, Writing, and Research in Grades 3-8, by Stephanie Harvey (1998); ISBN 1571100725

Supporting Struggling Readers and Writers: Strategies for Classroom Intervention, 3-6, by Dorothy S. Strickland, Kathy Ganske, Joanne K. Monroe (2002); ISBN 1-57110-055-5

Raptor! A Kid's Guide to Birds of Prey, by Christyna Laubach, Rene Laubach, and Charles W.G. Smith (2002); ISBN 1580174450

Web site

http://www.writedesignonline.com
This is a resource with a variety of text organizing graphic organizers

Informational Science Trade Books

As you develop resources for teaching text structures, begin with texts you already have in your classroom. You will find text structures in all expository writing. The following list of trade books has fifth grade science core connections that contain examples of the text structure listed.

Description

Electricity (Science Alive!), by Darlene Lauw (2002); ISBN 0-77870-561-7

Extremely Weird Animal Defenses (Extremely Weird), by Sarah Lovett (1997); ISBN 1-56261-358-8

Volcanoes, Seymour Simon; ISBN 0-688-14029-7

Mixtures & Compounds (Library of Science), by Alastair Smith, Phillip Clarke, and Corinne Henderson (Usborne Pub. Ltd., 200s); ISBN 0-7945-0082-X

Why Do Volcanoes Blow Their Tops?: Questions and Answers about Volcanoes and Earthquakes, by Melvin and Gilda Berger (1999); ISBN 0-439-09581-6

Sequence

Glaciers, by Larry Dane Brimner (2000); ISBN 0516271911

I Didn't Know that Quakes Split the Ground Open, by Clare Oliver; ISBN 0-7613-0795-8

Zap It! Exciting Electricity Activities, by Keith Good; ISBN 0-8225-3565-3

Volcano: The Eruption & Healing of Mount St. Helens, by Patricia Lauber (1986); ISBN 0689716796

Electricity (Science Alive!), by Darlene Lauw (2002); ISBN 0-77870-561-7

Chemistry, by Chris Oxlade (1999); ISBN 0-8172-4948-6

Compare and Contrast

How Plants Survive, by Kathleen V. Kudinski (2002); ISBN 0791074226

Chemistry, by Chris Oxlade (1999); ISBN 0-8172-4948-6

Cause and Effect

The Seven Wonders of the Natural World (Wonders of the World), by Reg Cox and Neil Morris (2001); ISBN 0-7910-6049-7

Zion National Park, by Mike Graf (2004); ISBN 0-7368-2222-4

Electricity (Science Alive!), by Darlene Lauw (2002); ISBN 0-77870-561-7

Planet Earth: All the Wonders of Our Blue Planet and the Secrets of a Vast Universe, by Diane Costa De Beauregard; ISBN 0 88682-953-4

Bryce Canyon National Park, by David Peterson (1996); ISBN 0-516-26094-4

Problem and Solution

Shocking Science: Fun & Fascinating Electrical Expertiments, by Shar Levine and Leslie Johnstone (1999); ISBN 0806922710

Text Structure Sentence Strips

Golden Eagles are powerful raptors with large dark brown bodies and small heads with golden crowns.

Golden Eagles soar high along ridges near their nests. They search for prey. When a meal is spotted, they attack in a long swoop.

Golden Eagles are apt to hunt for prey while Bald Eagles are more likely to take an easy meal.

Many Bald Eagles were killed by pesticides and illegal hunting. They were in danger of becoming extinct.

When a raptor species declines, scientists take wild bird eggs to raise in captivity and increase the number of birds.

Text Structure Word Cards

DESCRIPTION
SEQUENCE
COMPARE AND CONTRAST
CAUSE AND EFFECT
PROBLEM AND SOLUTION

Text Structure Samples

Description	1 "The earth's crust is made up mostly of hard, rocky substances, though some of these substances have crumbled into dirt from years of exposure to wind and rain and roots of plants. That crust is many miles thick (though the part under the ocean is thinner than the part on the land). Underneath the crust is a layer called the mantle. The mantle is about 1,800 miles thick. Below the mantle is the earth's core, which is made up of two layers called the inner core and outer core." Christopher Lampton, Earthquake, 1991 ISBN 0-395-63642-6
Description	2 "Do volcanoes erupt under the sea? Yes indeed. In fact, many more volcanoes may erupt underwater than erupt on land. They are called rift volcanoes. Rift volcanoes occur where two plates are pulling apart, usually between 1 and 2 miles below sea level. These volcanoes form as magma oozes up between the two plates. The magma fills in the gap, pushing the plates further apart. Rift volcanoes pop up under the Atlantic Ocean. The North American plate and the Eurasian plate are slowly separating. This means the Atlantic Ocean is growing wider! Friends on opposite sides of the Atlantic will be 1 inch farther apart next year." Berger, Melvin and Gilda. Why Do Volcanoes Blow Their Tops? 1999. p. 13 ISBN 0-439-09561-6
Description	3 "Would it surprise you to learn that corn is also a type of grass? It was first grown in Central America thousands of years ago. Its seeds are called kernels. Very few kernels grew on wild corn grass. It took thousands of years of choosing the corn grass plants with the biggest seeds, or kernels, to make what we enjoy today as corn on the cob." Ken Cameron, Plant Genetics, 2002, p. 11 ISBN 1-58344-938-8
Sequence	1 "Imagine you have a solid substance, such as ice. Heat it, which makes its temperature rise. When it reaches a certain level, the temperature stops rising and the substance begins to turn into a liquid. This temperature is called the substance's melting point. You keep heating. When all the solid has turned to liquid, the temperature begins to rise again. Eventually the temperature stops rising and the liquid begins to turn into a gas. The temperature at which this happens is called the boiling point. If you keep heating the temperature stays the same until all the liquid is gone. Then the temperature begins to rise again." Christ Oxlade, Chemsitry, 1999, p. 12-13 ISBN 0-81724-948-6

Compare/Contrast	1 "All matter has both physical and chemical properties and chemical properties. Physical properties are those that can be observed without changing the make-up, or identity of the matter. For example, clay is malleable, which means it will bend or flatten when squeezed. Squeezing changes the shape of the clay but does not change what the clay is made of. Malleability is an example of a physical property. Chemical properties describe matter based on its ability to change into a new kind of matter with different properties. For example, paper is flammable: it is capable of burning in the presence of oxygen. Flammability is a chemical property of paper. A chemical property of iron is its tendency to rust. Rusting occurs when iron reacts with oxygen to produce iron oxide. Reactivity to acid and to water are two more examples of chemical properties." ScienceSaurus, A Student Handbook, Great Source Educational Group, 2002, p. 251-252 ISBN 0-669-48191-2
Compare/Contrast	2 "An electrical circuit is made up of electrons moving in a circuit. Electrons are tiny bits of negative electricity that are found in all matter. In certain materials such as iron, electrons can move freely. These materials are good electrical conductors. In materials such as plastic, electrons are attached to larger particles and cannot move freely. These materials do not conduct electricity well, and are called non-conductors, or insulators. That is why a plastic spoon did not allow electrical current to pass through it in the Electric Stoppers experiment." Darlene Lauw, Science Alive Electricity. 2002, p. 10 ISBN 0-7787-0561-7
Compare/Contrast	3 "High overhead, plants such as orchids and ferns grow. They are adapted to life on tree branches where there's plenty of sunlight. They grew from windblown seeds or spores that once landed on the tree… These plants get the water they need from rain. They get minerals from dust and decaying leaves. They take nothing from the tree at all. Mistletoe lives in treetops, too, but it is a thief. Birds carry the plant's sticky seeds to a tree branch. The mistletoe's roots grow into the living wood and steal all the water and minerals the plant needs from the tree. Its leaves cast shade on the tree's leaves. It is a good thing for trees that mistletoe does not grow very large. " Kudlinski, Kathleen V. How Plants Survive. 2002. p. 12-13 ISBN 1-58273-708-8
Cause/Effect	1 "How do mountains like these disappear? The process begins with rain. As it rains, water seeps through cracks and joints in the stone. Chemicals in the water dissolve small grains of rock. Later on, the water freezes and thaws, prying loose bigger pieces of rock. These rocks grind against other rocks as they slide downhill. The wind carries away particles of dust left behind by these grinding rocks. In the end it can be said that wind, water, and gravity have hauled away these mountains." Peter Anderson, A Grand Canyon Journey: Tracing Time in Stone, 1997, p. 45, ISBN 0-531-20259-3

Cause/Effect	2 "Scientists think that at some point an early farmer noticed that some of the wild grass plants made larger seeds than others... The farmer picked out these larger seeds to plant. Then more plants with large seeds grew. The instructions for making plants with larger seeds were in the nucleus of each cell in the plant. After planting more and more of these large seeds each year, the ancient farmers would sometimes find one or two plants in their fields that had seeds that were a little bit bigger than the others. They used most of the seeds for flour, but kept the largest seeds they could find each year. Those seeds were saved for planting. After thousands of years of selecting, or choosing the biggest seeds, farmers ended up with what we know today as wheat. It came from nothing more than an ordinary grass." Cameron, Ken. Plant Genetics. 2002. p.8-9 ISBN 1-58344-938-8
Cause/Effect	3 "Earthquakes happen all over the world in areas called seismic zones. Seismic zones occur where the plates of crust covering the Earth's surface meet each other. Inside the Earth, the mantle is always moving, which in turn moves the plates. These plates push against each other, building up tension between them. When the tension between plates becomes too great, they grind against each other, causing the Earth's surface to tremble and shake." Robert Neumiller, Planet Earth, Creative Discoveries, 2001, p. 52 ISBN 0-886-82953-4
Cause/Effect	4 "As soon as mountains rise, they begin to be worn down steadily and slowly by the forces of erosion: wind, rain, moving water, and ice, as well as temperature and chemical changes. Some kinds of rocks, such as limestone, dissolve in water, but most water erosion on mountains is caused by streams and rivers that plunge down the steep sides, lifting up rocks and pushing them along to rub and scrape against other rocks. In cold climates, slowly moving rivers of ice called glaciers, also carve away at mountains. Rocks expand daily in the heat of the sun and then contract again during the cold nights. These constant temperature changes begin to crack the rock. Water gets into the tiny cracks, freezes at night, expands, and opens the cracks wider. Finally, the rock breaks off from the mountain. Sometimes the wind blows sand, which wears away mountains to produce towers such as these in Zion National Park in Utah." Simon, Seymor. Mountains, 1994. p. 19-20. ISBN 0-688-15477-8
Problem/Solution	1 "In summer, when long daylight hours stimulate growth in the sparse vegetation, musk oxen live well and grow fat. In winter, food plants lie deep under hard-packed snow, which the oxen scrape away with their hooves. This is the hungry time, when they survive mainly on the fat that they stored during the summer. Others, too, are hungry, including bands of timber wolves, which sometimes follow the musk oxen. In spring, when the calves are born, the wolves become particularly menacing. The musk oxen form a defensive ring, with calves and young animals in the middle. Even a dozen wolves attacking together stand little chance against that circle of lowered heads and sturdy horns." Stonehouse, Bernard. Defenders., 1999, p.26 ISBN 0-439-15347

Text Structure Definitions

DESCRIPTION

The writer explains phenomenon and processes by listing examples and unique characteristics.

SEQUENCE

The writer presents a series of events or explains a procedure or process in the order they happen.

COMPARE and CONTRAST

The writer discusses the similarities and differences of two ideas, objects, or processes.

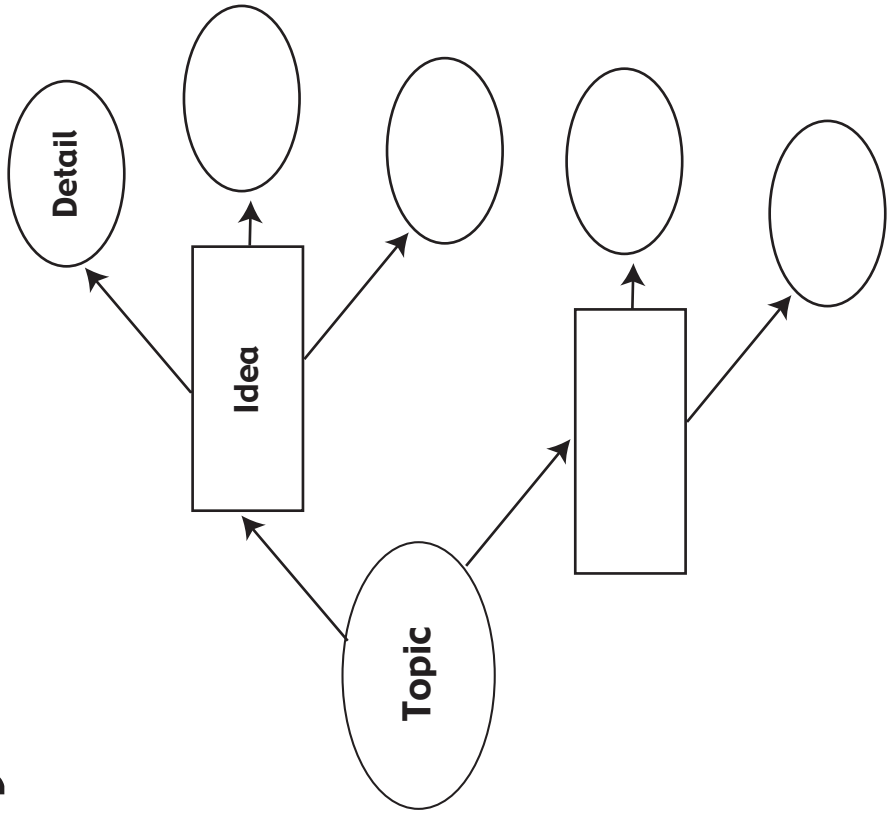

CAUSE and EFFECT
The writer explains the reasons for an event or phenomenon.

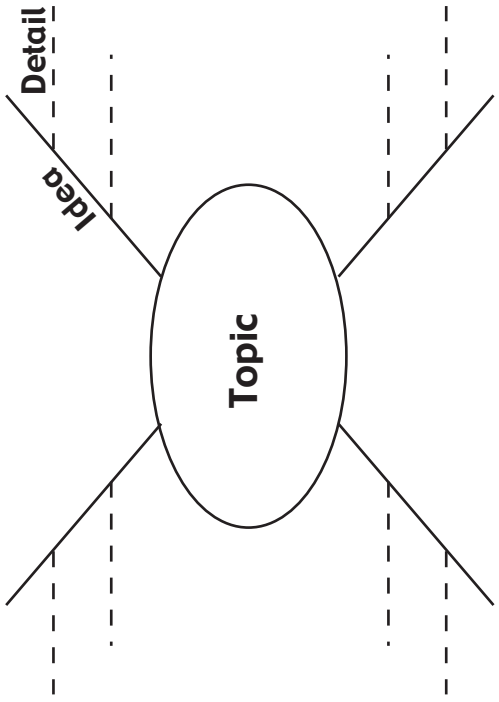
PROBLEM and SOLUTION

The writer presents a problem and one or more possible ways that it can be solved.

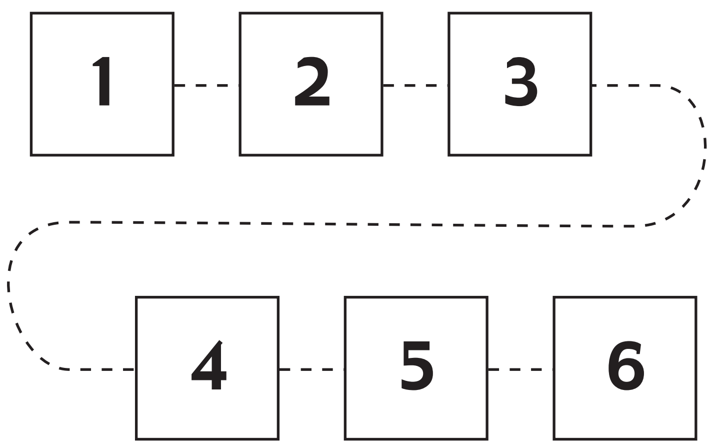
Text Structure Graphic Organizers

Description Graphic Organizers

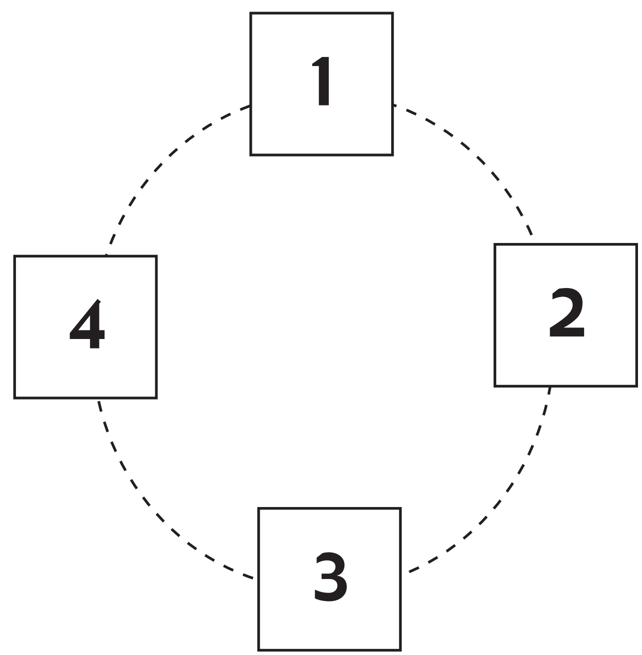




Sequence Graphic Organizers

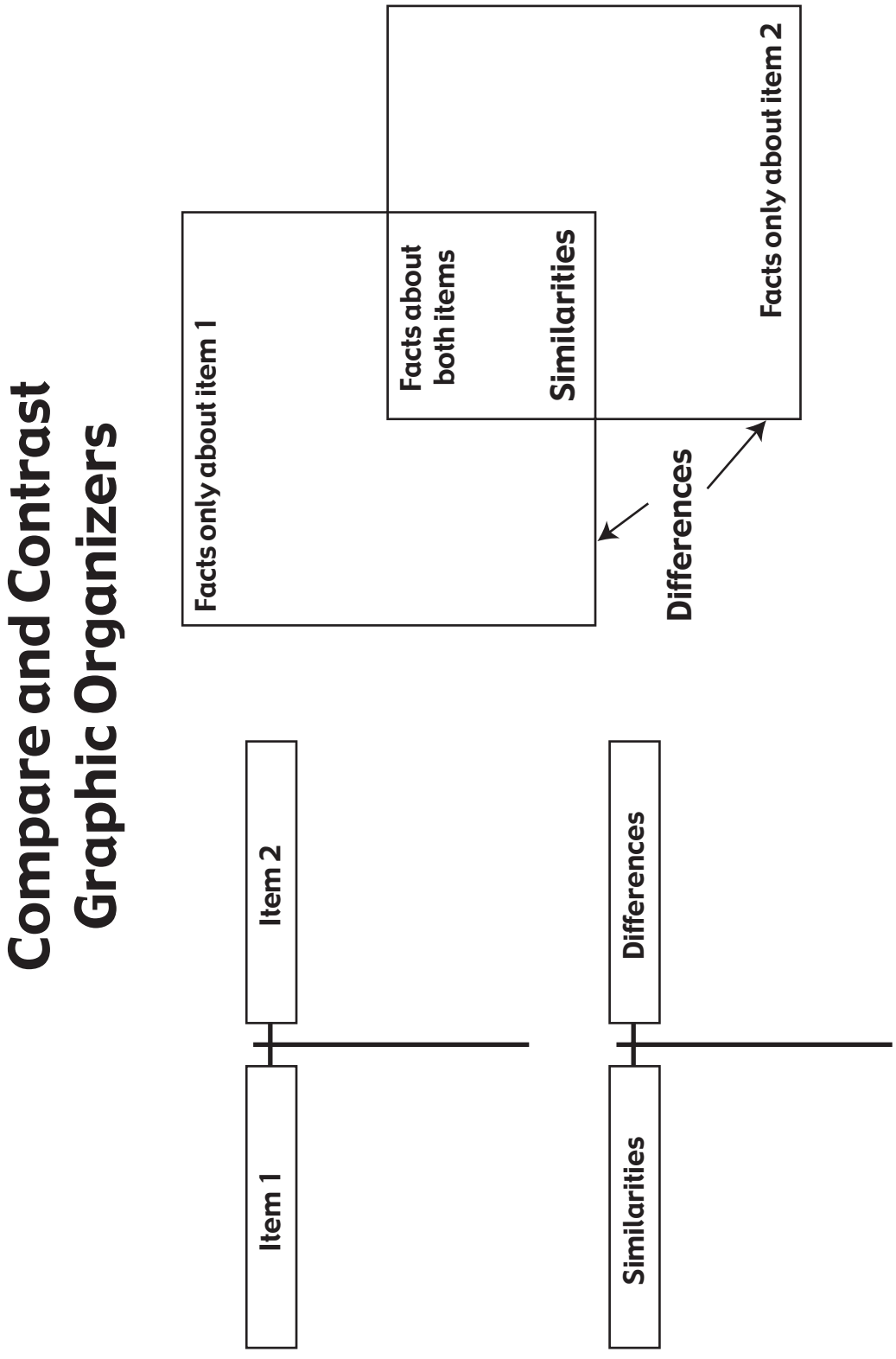


Series of Events

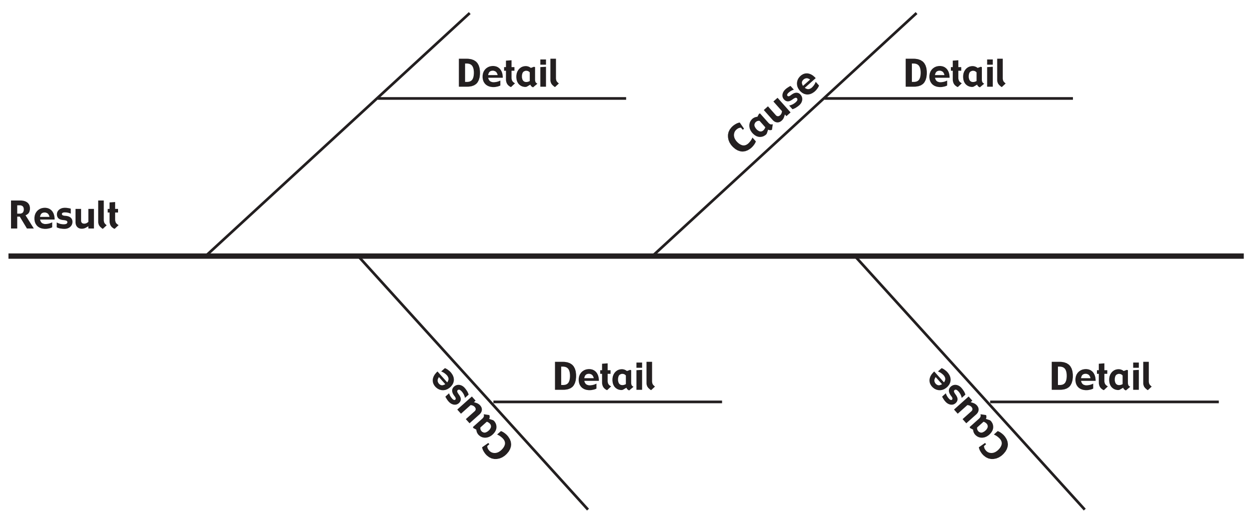


Cycle

Compare and Contrast Graphic Organizers



Cause and Effect Graphic Organizers



Problem and Solution Graphic Organizer