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Graphic Organizers Used as a Supplement to Science Textbooks Relating to Retention of Scientific Facts in Fourth Graders

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2nd Reader	Date
Director, Graduate Studies	Date

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Abstract

This research attempted to answer the question, do graphic organizers used as a supplement to science textbooks increase student retention of scientific facts in fourth grade? The researcher collected data from 56 fourth grade students in an urban school to find out whether the use of graphic organizers after reading sections of the science textbook improved retention of scientific facts in fourth graders. The researcher used baseline science test assessments, reading levels of students, tests and quizzes after the use of graphic organizers, along with teacher and students surveys and interviews in this study. These pieces of data were studied to find generalizations about student ability and retention after using the graphic organizers, student confidence and attitude when allowed to use graphic organizers, and perceptions of students and teachers about the usefulness of graphic organizers in the classroom.

Chapter 1

Statement of the Problem

Introduction

As a visual method of showing students new information, graphic organizers can be used to discuss, record, reason, and sort out ideas in any content area. Many researchers have agreed that graphic organizers are helpful for learners when they are planning, recording, and organizing information. Bromley, Irwin-De Vitis, and Modlo (1995) wrote:

> Graphic organizers make visually explicit the organizational patterns of text. They can be enlisted to facilitate prereading, postreading, prewriting, revising, discussing, and reasoning. They can represent students' background knowledge and provide a framework for what is about to be learned, or can be used to organize and reflect on newly acquired knowledge. As teachers and students create graphic organizers together, they learn from each other as they extend their understandings of concepts. (p. 6-7)

Science books have notoriously been difficult texts for students to read. In addition to new terms, the students also must understand and be able to discuss and apply scientific information in various settings. This research seeks to find out whether graphic organizers can be helpful when elementary students use them in conjunction with science books to organize new information, thus making it easier to recall, discuss, and reason.

Research Question

Do graphic organizers used as a supplement to science textbooks increase student retention of scientific facts in fourth grade? This study was designed to determine whether the use of graphic organizers to supplement a science textbook increases student retention of scientific facts. The researcher implemented graphic organizers after the students had completed and data was taken from two baseline science unit tests without the use of organizers, and then took data from eight tests after students used graphic organizers. Results were examined by students' reading levels and individually to see whether graphic organizers helped students comprehend and retain scientific facts. In addition, surveys were given to the students in the fourth grade class to determine whether or not the graphic organizers were an effective tool to raise confidence levels in students and make the text less confusing. The researcher also administered surveys to twenty teachers (grades Kindergarten through four) in the elementary school being studying to examine how graphic organizers are used in the grades leading up to fourth.

Limitations

Research has shown that when graphic organizers are used to supplement science textbooks, student scores on tests increase. However, this particular research was limited to a small group

of 58 students in three fourth grade classrooms, one being an inclusion classroom, in an urban environment. In addition, the graphic organizers were used as a supplement to only one science textbook (*Scott Foresman Science*, 2003). Given the limitations of the sample, these results may not be applicable to other grade levels, school settings, or science textbooks.

Definition of Terms

Graphic organizers: "Visio-spatial arrangements of information containing words or statements connected graphically in a meaningful way" (Thompson & Thomason, 2001, pg. 10).

Reading Level: The stage of reading ability each child is at during a given point in the year, according to Fountas and Pinnell (2001) and as tested by a teacher in a Directed Reading Assessment.

Science Textbook: *Scott Foresman Science* book that matches the fourth grade science curriculum, published in 2003. The science book contains two sections (Life Science and Physical Science), with several chapters in each section. Each section is broken down into a different lesson pertaining to the subject in the chapter.

Science Tests: *Scott Foresman Science* published assessments that can be given by section or chapter.

Chapter 2

Review of the Literature

Introduction

Textbooks are used as a primary method of teaching content when it is necessary for students to comprehend a multitude of facts in order to fully understand a subject. Students then must use these facts in conjunction with the higher order thinking skills that are necessary to analyze, synthesize, and evaluate information (Ennis, 1987, as cited in Ivie, 1998). David Ausubel (1963) believed that good learners have the conventions that allow them to use higher order thinking skills naturally. As they encounter textbook information, they store it, and are able to pull it out and generalize it when needed. The minds of good learners, he attested, were already programmed to anchor ideas abstractly described in textbooks (Ausubel, 1963, as cited in Ivie, 1998). Some learners, however, do not innately have the capacity to hold ideas and later pull them out for practical use.

What are Graphic Organizers?

Many methods have been employed to try to help learners who have difficulty storing and retrieving information from texts. One technique that has become popular in recent years is that of using graphic organizers as a supplementary learning tool.

Graphic organizers are defined as "Visio spatial arrangements of information containing words or statements connected graphically in a meaningful way" (Thompson & Thomason, 2001, pg. 10). They are tools used by students to establish organization patterns that can be used when they report out or write about a subject. Students use them by visually scribing information that they have read or thought about in texts, literature, or lectures. In this way, the new information becomes visual (Jones, 2000; and Thompson & Thomason, 2001).

Teachers who use graphic organizers along with textbooks hope that the visual representation of information will aid learners in their ability to link the organization style of textbooks to a pattern of higher order thinking. Graphic organizers can be created to model the same format in which information is presented in a textbook: a sequential pattern, comparison/contrast, cause and effect, or a problem and solutions. These outlines enable learners to assess the information visually, linking information from the textbook to the order thinking process required to learn (Thompson & Thomason, 2001).

Researchers have studied several types of graphic organizers that educators believe result in substantial, long lasting learning outcomes. Irwin, Modlo, and Bromley gave the most comprehensive explanation of types of graphic organizers

(1995). Four types of graphic organizers that learners can use to reorganize thoughts and improve information recall are explained below.

The first type, a hierarchical organizer, is set up with main concepts and the sub-concepts for each concept. This type of organizer is used to supplement subjects that have positions and levels. For example, a student who is studying the United States Government might use a hierarchical graphic organizer that looks somewhat like a tree. Its "trunk" contains the main idea of democracy, while the branches include information about different sections of the government.

A conceptual graphic organizer shows the relationships among different concepts. Students might use a conceptual organizer when looking at characteristics or examples of concepts and how they relate to each other (Flood & Lapp, 1988). A Venn Diagram is a type of conceptual organizer used in many classrooms. The two inter-locking circles of a Venn Diagram let students visualize the ways that two concepts are different and alike.

The last two types of organizers are the sequential graphic organizer and the cyclical graphic organizer. The sequential organizer shows events in the order that they occur, such as on a timeline. A cyclical organizer shows a series of events in a

process in a circular arrangement. A well-known example of a cyclical organizer is a picture of the water cycle.

When are Graphic Organizers Used?

As a "Visual depiction of knowledge," (Irwin, Modlo, & Bromley 1995, p. 52), graphic organizers can be used in many learning situations in the classroom to help students organize and focus their ideas. During lectures, some teachers provide students with guided notes in the form of graphic organizers. Students who have difficulty listening to a speaker and taking coherent notes can then listen and have a directed method of recording what they hear. Here, the students' attention can be focused on important ideas in the lecture (Jones, 2000; and Thompson & Thomason, 2001).

Graphic organizers can also be used to enhance reading, writing, thinking, and speaking skills. For example, a student using a graphic organizer can take notes on a piece of literature. The organizer can be set up as a map for a student to keep track of the plot, setting, characters, and so on in a novel. In addition, as discussed before, graphic organizers are beneficial tools when students use them to organize new ideas they read about in textbooks. These tools allow students to sort out information thus clearing the clutter that sometimes comes with the learning process (Davey, 1983).

Another effective use of graphic organizers is during the planning stages of writing. Students use the organizers to set up a writing piece by making visual the higher order thinking skills necessary to plan the sequential events of a story (Ivie, 1998).

Why are Graphic Organizers Used?

Graphic organizers help students think efficiently because they organize ideas into patterns that follow thought processes. The organizers tend to work the way the mind works. According to researchers, graphic organizers are effective in sorting information as it is presented to learners. The visual representation of data helps learners connect new ideas with a method of filing the new ideas in the brain (Davey, 1983).

What follows are the key ideas that researchers have claimed make graphic organizers an effective tool to use with learners who may need the extra push in utilizing higher order thinking skills when comprehending new information.

Graphic Organizers Coincide with the Brain

Ausubel's research indicates that as the brain learns, the new information becomes filed in mental categories. These categories are then accessed when information needs to be recalled (Ausubel, 1960, as cited in Ivie, 1998). Ausubel's theory postulates that due to the brain's cognitive structure, the present experience that the learner is having while

acquiring new information fits into what the learner already knows. The brain files the information in a hierarchical pyramid fashion; the most general information at the bottom in a broad area, and more detailed at the top in a smaller area. Organizers can match hierarchical thinking in this way. Ausubel believes that organizers can bridge the gap between background knowledge and new information (Ausubel, 1960 as cited in Ivie, 1998). Thus, a graphic organizer lets the mind connect the visual categories with the categories that need to be stored.

Graphic Organizers Clear Clutter in the Brain and on the Page

Especially in the case of textbooks, specific new information is usually clumped together in a chapter full of many new ideas. A single idea might be difficult for a learner to remember if it is read about once in a sentence that might contain another new idea. For example, a science chapter might contain information about the adaptation that helps a walrus survive in cold water. However, the idea is in the midst of other adaptations of many other animals. For a learner who might be confused by receiving multiple new ideas at once, it might be hard to clear the clutter of the words and remember the specific adaptation of a walrus. However, this information can be pulled out of the book and put into a specific spot on a graphic organizer, therefore isolated from all other information in the chapter (Irwin, Modlo, & Bromley, 1995). When a learner

can separate important information from other information in a text, it is easier to see the connections between concepts, and therefore simplifying the task at hand (Novak & Gowin, 1984).

Graphic Organizers Help with Memory

According to Ausubel, retention is influenced by three factors. The first is the brain's ability to assimilate new information with the background knowledge that one already owns. The brain has to fit new ideas with what it already understands about the world. This leads to the second factor that influences memory. In order for one to remember information, the brain must see concepts as stable and clear. The concepts must be understood and believed to be true, or the brain will not retain the new information. Finally, the brain must be able to discriminate new information from the task that the learner is using to learn the new information (Ausubel, 1963, as cited in Ivie, 1998). A graphic organizer can be used to aid in memory because new information visually laid out makes it easier for a learner to make ideas clear and easy to understand. Information might be easier for students to understand if it is graphically represented (Irwin, Modlo, & Bromley, 1995).

Graphic Organizers Engage

Studies show that when learners are actively engaged in an activity, they are more likely to remember the information they are learning (Irwin, Modlo, & Bromley, 1995 and Jones, 2000).

The practice of making or filling out graphic organizers allows students to print, visualize, and speak about subjects. It is important though, when using graphic organizers, that students also engage in listening, speaking, reading, and writing about a subject to ensure that it becomes concrete. It this way, students are engaged and actively involved in the subject they are studying.

Graphic Organizers in the Content Areas

A number of studies on graphic organizers focused on whether graphic organizers help with memory and clear clutter (Horton, Lovitt, & Bergerud, 1990). Many researchers believe that graphic organizers turn ideas into blueprints, thus making the abstract visual. Hawk (1986) determined that using graphic organizers after teaching new science concepts greatly improved test scores of middle school students during a time when science becomes even more complex. Subjects that were once abstract could become concrete. The tools also help students generalize the process involved in organizing the ideas and transfer it to other learning situations. Students are able to use the organizers in other learning settings, and the organizers assist them in being able to cluster new information (Thompson & Thomason, 2001).

Using Graphic Organizers to Activate Prior Knowledge

Alvermann and Hynd's 1989 study concluded that students come into classrooms with certain ideas about the world that may be naïve or incorrect. The researchers gave an initial test about Newton's Theory to students enrolled in a high school physics class. They found that many students were confused on what they felt would be simple background concepts such as gravity. One suggestion was that to use graphic organizers with a class before teaching a science unit could be beneficial in helping teachers identify students' misconceptions about a topic. Teachers who allow students to fill in what they believe can bring the organizers back and refer to misconceptions as they are teaching (Alvermann & Hynd, 1989).

Graphic Organizers and Science Textbooks

Researchers have found that, due to the abstract and confusing nature of some content area textbooks, graphic organizers have proven to be an effective tool. For example, science textbooks may be quite difficult for students to read. There is new factual information, new technical and scientific terms, and sometimes a significantly higher reading level than the grade for which the science books are written (Gilliland, 1972).

Teachers seek ways to simplify the science concepts from these complex textbooks and make information easier to recall

without revamping or throwing away the texts. By clustering and de-tangling information, graphic organizers can decrease the work it takes to understand and remember science information. Studies completed in science classrooms have shown that when students use graphic organizers after reading specific passages in science textbooks, students have higher assessment scores (Horton, Lovitt, & Bergerud, 1990). A study completed on a science class of middle school students showed that the scores of both learning disabled and non-learning disabled students were higher when using graphic organizers than when the students simply read textbooks and employed their own methods of self-study before an assessment. The organizers in the aforementioned study were used to visually represent vocabulary and other important ideas from the science textbook. The organizers again allowed students to learn how to structure their thinking (Horton, Lovitt, & Bergerud, 1990).

Research conducted by Lehmann (1992) indicates that students who were low performing on tests had improved test scores when they began using graphic organizers after reading textbooks. They were able to view the organizers before reading the text. Lehmann (1992) found that students who used matrix and branch style organizers that were surveyed felt graphic organizers let them understand the objectives of what they were supposed to be learning (Lehmann, 1992).

Another study by Dunston (1992) concluded that when elementary students looked at graphic organizers before reading a content area text, information recall was significantly better than when students had no graphic organizer at all. In addition, having students construct graphic organizers after reading also improved recall for elementary students (Dunston, 1992 as cited in Bromley, Irwin-De Vitis, & Modlo, 1995). For high school students, graphic organizers helped in recall of vocabulary and improved comprehension in general (Dunston, 1992 as cited in Bromley, Irwin-De Vitis, & Modlo, 1995). Beginning the practice of using graphic organizers early allows students to carry this tool of organization with them through the learning years (Bromley, Irwin-De Vitis, & Modlo, 1995).

The above studies all seem to support that graphic organizers, when implemented in the classroom, have positive effects on retention of facts for students with and without learning disabilities. However, some educators do not agree that graphic organizers can always be helpful tools. There are some studies that show no results when graphic organizers were used to supplement various types of units in the classroom (Carnes, Lindbeck & Griffen, 1987; and Clements-Davis & Ley, 1991). In their 1987 study, Carnes, Lindbeck & Griffen found no improvement on information recall during a microcomputer physics tutorial. Clements-Davis & Ley (1991) also found no results on

recall when they implemented graphic organizers in a high school English classroom. A common thread in these studies is that the studies were completed on groups of students who had never been trained to use the graphic organizers. It appears important that students know how to use the organization tool in order to get positive results with memory and recall.

Conclusion

Marilew Bartling, a first grade teacher interviewed in Bromley, Irwin-De Vitis, and Modlo's book *Graphic Organizers* (1995), was quoted as saying:

> Graphic organizers are an excellent tool to help children understand the concept of categorizing…Even when students have moved from categorizing objects and pictures to words, they still need to see the information in a visual way. Graphic organizers are a logical way to do that. (p. 104)

For some students, the higher-order thinking skills necessary to categorize, analyze, and synthesize are not fully developed. These students need supports. By using graphic organizers, especially in correlation with science textbooks, students are able to learn and recall new information from a particular unit, and acquire the skills necessary to categorize and organize. When students learn to evaluate how graphic organizers assist them and provide them with the skills needed to organize and understand new material, they can be empowered to use them to assist with learning.

Chapter 3

Methodology

Introduction

This study was carried out in an urban elementary school (Grades K-6) located in Western New York. The researcher sought to determine whether the use graphic organizers as a supplement to a science textbook would increase retention of scientific facts in fourth graders. The researcher investigated whether the teachers and students felt the organizers reduced clutter and made information easier to understand and remember. Because the graphic organizers were used in along with a textbook, the researcher also looked at reading levels to find out if there was a connection between students' reading levels and improvement in test scores after using graphic organizers. In addition, the study was designed to look at students' attitudes toward the graphic organizers in comparison.

Subjects

The present study was conducted in three fourth grade classrooms in an urban elementary school in Western New York. The total enrollment of students at this school is about 500. The subjects of the study were members of three separate classes. During the school morning, each class rotated into three different classrooms for an hour each of instruction in

mathematics, reading, and science. The researcher saw each class for one hour each day for science instruction.

All together, the fourth grade classes contained 56 students. The ethnic makeup of the subject group was as follows: 55 percent African American, 23 percent Hispanic, 21 percent Caucasian, and 1 percent Asian. The gender distribution was as follows: 55 percent male and 45 percent female. Of the 56 students, six had Individualized Education Plans, and one had a 504 Plan.

During this study, the researcher collected data for thirteen weeks during the second half of the school year. The researcher collected the data in an attempt to examine the question: Do graphic organizers used as a supplement to science textbooks increase student retention of scientific facts in fourth grade?

Research Design

The study was designed to investigate the usefulness of graphic organizers, the effects of graphic organizers on students' test scores, and students' attitudes toward the use of graphic organizers to understand the science material. In order to collect accurate, reliable, and valid reading of data, information was gathered from various sources throughout this study.

Data Collection Instruments

Before data was collected, unobtrusive data about the reading levels of each student participating in the study was obtained. This reading assessment was called *Directed Reading Assessment* (Fountas & Pinnell, 2001) (see Appendix A) In the beginning of fourth grade, each student was assessed by the reading teacher to identify his or her reading level according to the Fountas and Pinnell leveled reading system. In this assessment, students independently read a story. Before they read, the assessor asks them to make some predictions about the story. After the student reads the story, the assessor asks the student to retell the story, make an inference, give general responses, and make connections to other stories. The observation sheet is provided by Fountas and Pinnell, and has directed questions for the assessor to ask the student. The data was in no way influenced by the researcher.

Data was also collected from science tests and quizzes. The tests and quizzes used were published tests from the Scott Foresman Science Program (*Science Scott Foresman Science*, 2003). The researcher collected two baseline unit test scores from prior to the use of graphic organizers. Four organizers were then used in each of two units to supplement the science text, followed by two unit tests (see Appendices B-C). In addition, during the next unit, graphic organizers were used to supplement

each section in the unit, and a quiz was given the day after each graphic organizer was given (See Appendices D-I). This allowed the researcher to collect data on short and long term results of science recall after using the organizers.

Students surveys were given two times, once after the first two unit tests, and again after the last full unit test (See Appendix J). The surveys asked students how they felt about using the graphic organizers- whether graphic organizers helped them better understand information, study for tests, and feel more confident about science material. Each student involved in the study completed the surveys. In addition, a focus group of ten students was selected for a more in depth interview (See Appendix K). The researcher asked each student five questions about whether they felt graphic organizers helped them remember information, study, and feel more confident.

Finally, teachers in the elementary school in which the study was conducted were asked to fill out a survey about how often and during what subjects they use graphic organizers (See Appendix L). The researcher included this survey to find out whether teachers in grades preceding and including fourth grade used graphic organizers in science, and how they feel about the effectiveness of graphic organizers.

Triangulation of Data

The researcher used multiple data collection instruments in order to get a clear sampling of information about graphic organizers and to ensure that the research was reliable. The use of various tools also allowed the researcher to triangulate the data. The reading level data, test and quiz scores, student surveys, and teacher survey were analyzed and compared to get a full view of the different ways graphic organizers might work as a supplement to a science textbook in fourth grade. The chart below depicts how the four data collection instruments were used to view different parts of the research question.

Triangulation of Data

	Reading Levels	Test and Quiz Scores	Student Survey	Teacher Survey	Student Interview
Retention and Ability	X	X		X	X
Attitudes and Confidence			X	X	X
Usefulness in Classroom	X	X		X	X

Data Analysis

Data was analyzed carefully several times to find recurring themes and generalizations. The researcher viewed quantitative data, including averages of test scores and correlations between tests. Qualitative data was also looked at by the researcher to

understand how students and teachers feel about using graphic organizers in science.

As seen in the above chart, data were also triangulated to guarantee reliability and validity. In addition, the study was carried out in a regular classroom setting. The classroom environment remained unchanged. Thus, this study has a high validity and reliability.

Chapter 4

Results

Introduction

Do graphic organizers used as a supplement to science textbooks increase student retention of scientific facts in fourth grade? The researcher examined three main areas pertaining to graphic organizers: retention and ability, attitudes and confidence, and usefulness in the classroom. Data from the tests, surveys, and interviews were carefully analyzed to find generalizations.

Retention and Ability

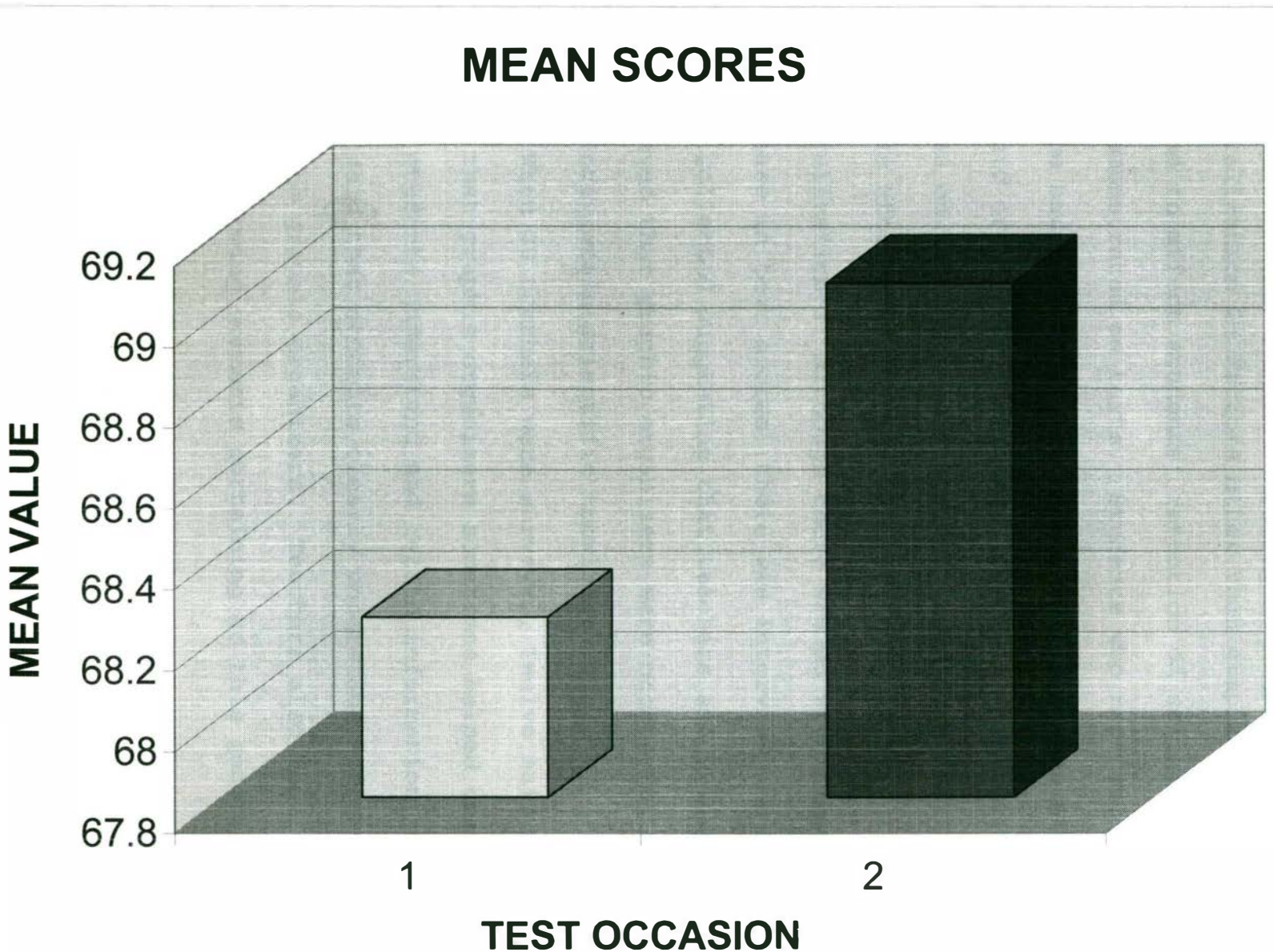
The first research question was designed to determine whether the use of graphic organizers increased retention of scientific facts in fourth graders. The researcher analyzed from four sources to determine whether graphic organizers were indeed useful in increasing retention. The students' reading levels were viewed unobtrusively, and the researcher used these to look at test scores, comparing whether there was a difference in students' retention with the use of graphic organizers in the higher and lower reading levels. The researcher also distributed a teacher survey and collected qualitative data concerning teachers' views of whether graphic organizers increased retention in their students. Further data was provided when the researcher conducted a student interview to

get an idea of how students felt about using the organizers and if they thought they made information from the science textbook easier to remember.

Generalizations Pertaining to Retention

The following generalizations were made based upon the student reading levels, test scores, teacher surveys, and student interviews.

- Generalization 1: There was no significant increase in retention after using graphic organizers based on a comparison of the baseline average test scores and the average test scores after using graphic organizers.
  - Students in lower reading level groups (K, J, L, M), middle reading level groups (N, O, P) and high reading level groups (Q, R) showed no significant increase in retention of scientific facts according to a comparison of the average of baseline test scores and test scores after the use of graphic organizers. This generalization is illustrated in the following graph:


MEAN SCORES
MEAN VALUE
69.2
69
68.8
68.6
68.4
68.2
68
67.8
1
2
TEST OCCASION

- Generalization 2: Factors other than graphic organizers seemed to affect students' retention of science information as demonstrated on tests. Students who received low scores in the baseline tests also received low scores after the graphic organizers were used. Students who received high scores on the baseline tests continued to receive high scores after graphic organizers were given.
- Generalization 3: Although there was no significant increase in test scores, there was interview and survey data collected suggesting that teachers and students believed that graphic organizers were successful in helping students retain scientific knowledge.
    - When 20 teachers were surveyed, twelve said they felt that graphic organizers sometimes helped their students understand and retain information, and eight said that students clearly understand information from the graphic organizers. Teachers also made the following comments pertaining to this generalization:

Participants' Perceptions:	Sample Teacher Comments
Graphic organizers help students and are useful in the classroom because they help students retain information that might otherwise be confusing.	• "Graphic organizers seem to help students go back through and review major ideas. When they are studying for tests, they can have a guide and not be pressured to go back and read through a textbook."-Grade 3 Teacher • "I like to use graphic organizers for daily review. It gives the students an idea about what they need to know and what information is extra."-Grade 2 Teacher

➢ A group of ten focus students was interviewed about how they felt about using graphic organizers in science. Students were asked if graphic organizers made information easier to remember. The following chart illustrates how the students responded to the generalization:

Participants' Perceptions	Sample Student Comments
Graphic organizers make information easier to remember.	• "They make information easy to remember because they have main ideas and details. I understand them better than rereading through the book."-Grade 4 student • "I like them because I can look at the paper and find what I need to know, then it stays in my head."- Grade 4 student • "I always remember the

	themes of the organizer, and this helps me remember information under the themes."-Grade 4 student • "The graphic organizers are nice because I like to rewrite what we read. It helps me remember later what we read."-Grade 4 student • "It's easier to remember pictures and what words came under the pictures."-Grade 4 student

Attitudes and Confidence

The second part of the research was to determine whether using graphic organizers helped students build confidence and have a positive attitude when going into a testing situation. The researcher used the student surveys, teacher surveys, and student interviews to examine whether students and teachers feel that using graphic organizers helps to increase confidence levels. In addition, the researcher used these tools to determine if the graphic organizers changed student attitudes towards taking science tests.

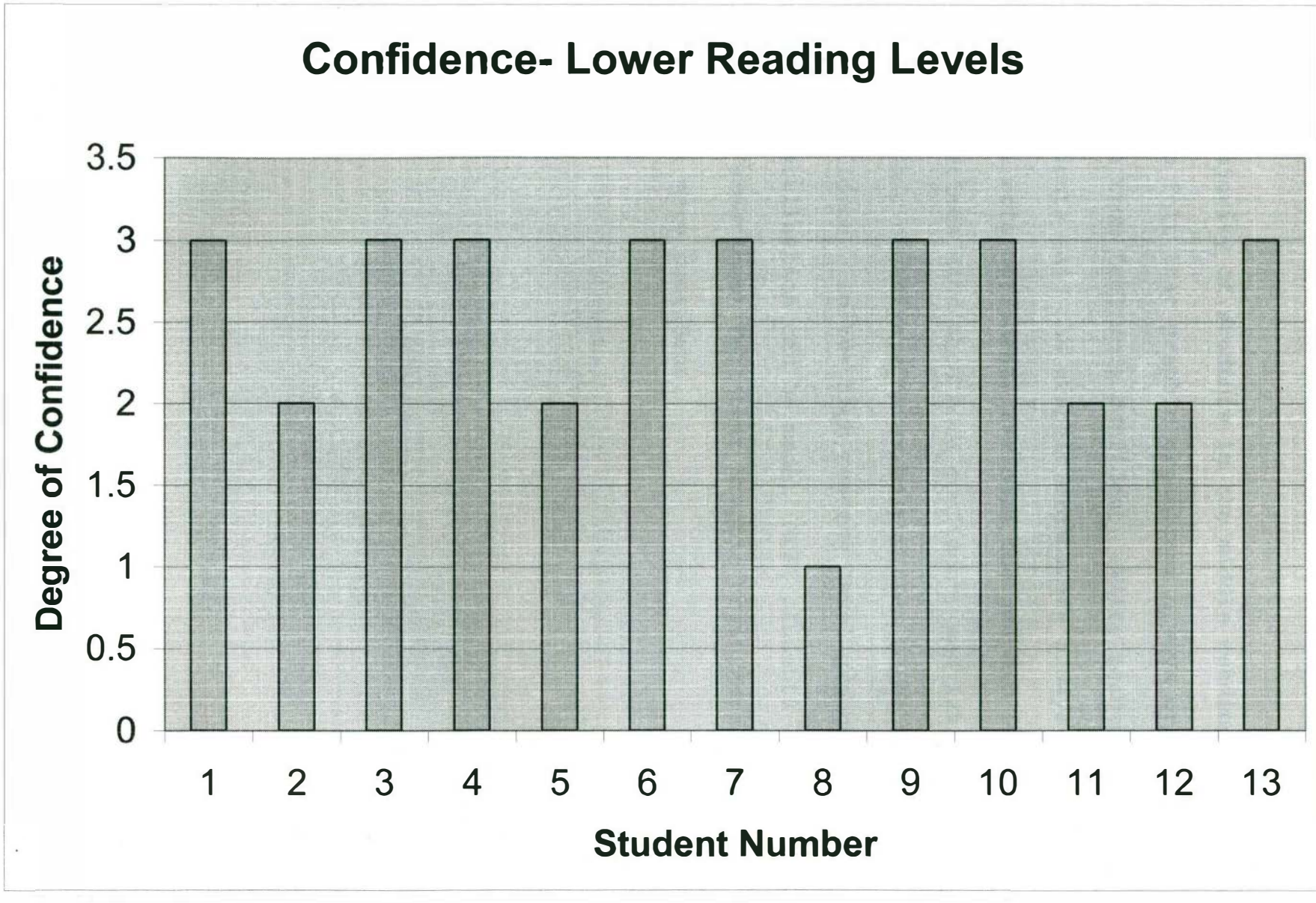
Generalizations Pertaining to Attitudes and Confidence

The following generalizations were made based upon teacher surveys, student surveys, and student interviews:

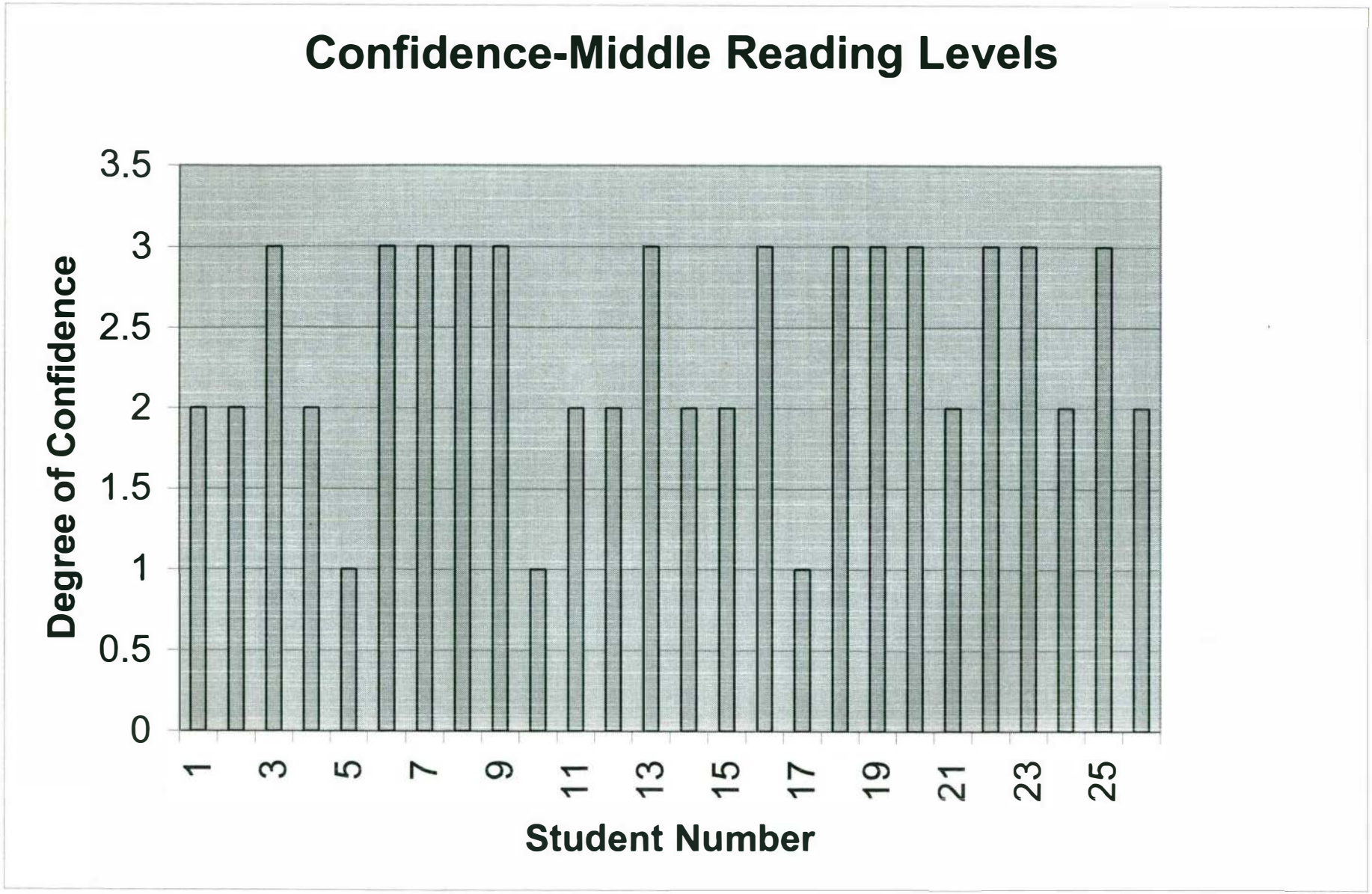
- Generalization 4: A majority of students in the lower, middle, and high reading level groups felt that graphic

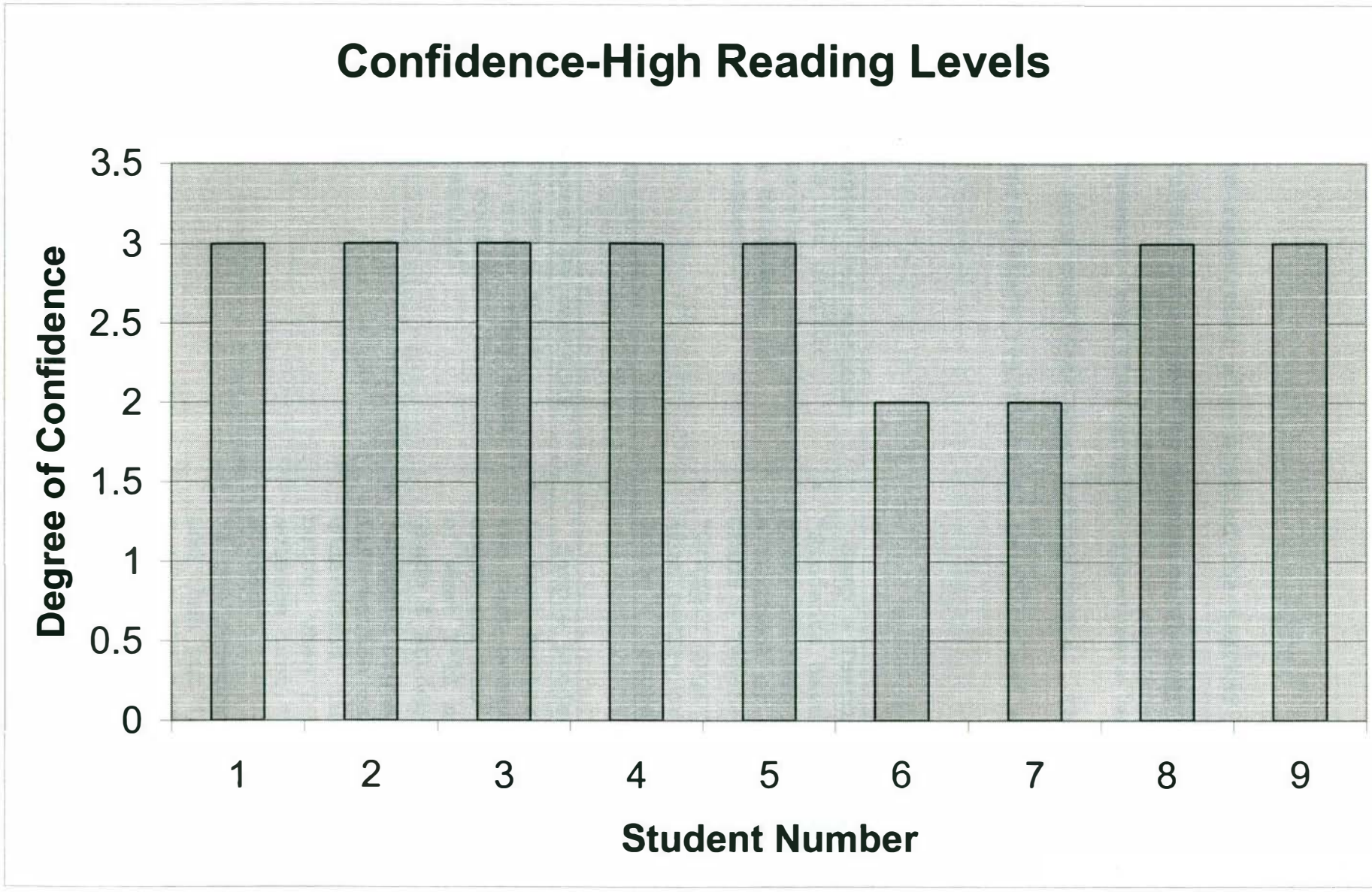
organizers were always or sometimes helpful in making them feel more confident.

- According to the student survey, 48% of students in the lower reading level groups said that graphic organizers always helped them feel more confident about taking science tests (a score given on the chart below of a 3). Forty-three percent of these students felt that the graphic organizers sometimes made them feel more confident, and 9% felt that the graphic organizers never made them feel more confident (scores given of 2 and 1 on the chart below, respectively).


Confidence- Lower Reading Levels
Degree of Confidence
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Student Number

- A majority of students in the middle reading level groups also felt that graphic organizers always or sometimes made them feel more confident. Fifty percent of these students said the graphic organizers always made them feel more confident, 38% said the graphic organizers sometimes made them more confident, and 12% said the graphic organizers never helped them to be more confident. In the high reading level groups, the same generalization can be made. Most students (78% always, 22% sometimes) felt that graphic organizers made them feel more confident.


Confidence-Middle Reading Levels
Degree of Confidence
3.5
3
2.5
2
1.5
1
0.5
0
1
3
5
7
9
11
13
15
17
19
21
23
25
Student Number


Confidence-High Reading Levels
Degree of Confidence
3.5
3
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
Student Number

- The researcher also studied the teacher surveys and student interviews to determine whether teachers and students felt that graphic organizers helped students be more confident when taking tests. The following charts state reactions of teachers and students:

Participants' Perceptions	Sample Teacher Comments
When students use graphic organizers to study, they seem to feel more confident in testing situations.	• "Students have something to study instead of simply using a textbook or worksheets."- Grade 5 Teacher • "Graphic organizers are a nice review or study guide."- Grade 4 Teacher

Participants' Perceptions	Sample Student Comments
When students use graphic organizers to study, they seem to feel more confident in testing situations.	• "I feel better when I take the test because the graphic organizer has given me a hint of what I'll need to know."- Grade 4 student • "Graphic organizers make the information easier to understand. Then I feel better when I go to take a science test."-Grade 4 student • "I can remember main ideas and then put in details when I take the tests."-Grade 4 student

Usefulness in the Classroom

The researcher used the above generalizations made with reference to various data (reading levels, test scores, teacher surveys, student surveys, and student interviews) along with additional data from the teacher surveys and student interviews to understand whether graphic organizers used as a supplement to the science textbook are a useful took in the classroom.

Generalizations Pertaining to Usefulness in the Classroom

- Generalization 5: According to this particular study, graphic organizers were not useful in helping students raise test scores in ways beyond retention.
    - Students who received high test scores in the baseline assessments continued to receive high scores after the use of graphic organizers, yet the scores did not increase or decrease significantly.
- Generalization 6: According to the qualitative data obtained from teacher surveys and student interviews, graphic organizers are useful in the classroom.
    - Although they did not significantly increase test scores based upon this study, teachers and students believe that graphic organizers are useful for various reasons:

Participants' Perceptions	Sample Teacher or Student Comments
Graphic organizers help students clear clutter.	• "Graphic organizers help students put their thoughts

	into sequence. They help guide them."-Grade 4 Teacher • "They provide a word bank or key idea bank for students in science. Students can take confusing information from the textbook and put it in order."-Grade 4 Teacher • "Graphic organizers help students organize their thoughts into proper categories."-Grade 3 Teacher • "Graphic organizers are very helpful when planning or organizing. They help students who struggle to see the bigger picture to have a sense of direction."-Grade 4 Teacher • "When I am confused, I picture the graphic organizer in my head and remember how the information was in order."-Grade 4 student • "On a big test, I can't remember everything from the book. That's too confusing. I like to think about the main ideas on the graphic organizers."-Grade 4 student
Graphic organizers are a useful tool to use with many different types of learners.	• "Since most learners are visual or kinesthetic, graphic organizers are a useful tool. Used with clear instruction, the auditory learner is also accommodated!"-Grade 2 Teacher • "Graphic organizers emphasize different skills that are very effective (Venn Diagrams, comparing and contrasting)."-Grade 4-6 Teacher • "When we use the graphic

	organizers I like that we read first, then write and discuss."-Grade 4 student • "Graphic organizers have pictures that help me remember what we wrote and talked about before I take a test and when I am taking a test."-Grade 4 student
Students enjoy using graphic organizers.	• "Students enjoy using images and color to categorize information."-Grade 4 Teacher • "My students seem to like when we use a graphic organizer after a read-aloud."-Grade 1 Teacher • "Graphic organizers are fun because there are pictures and sections to write in."-Grade 4 student • "I like to draw in pictures and then make my own captions."-Grade 4 student • "It's a challenge to study, but it's more fun to study your own words!"-Grade 4 student • "The graphic organizers are more interesting to look at. You can also add your own ideas."-Grade 4 student • "I like when we use graphic organizers in a group. It is fun to work in a group and with the graphic organizers we have things to talk about."-Grade 4 student • "The circles, lines, and pictures make learning more fun."-Grade 4 student

Chapter 5

Implications

Research on Current Findings

According to statistical data, the graphic organizers used in this study did not significantly increase student retention of scientific facts in fourth grade. However, qualitative data showed that:

- Many teachers feel that graphic organizers are useful in the classroom if taught clearly and over a period of time. Teachers feel the graphic organizers help students clear clutter, organize, plan, and sequence information.
- Fourth grade students enjoy using graphic organizers. They believe the organizers make it easier to decide which information in the science book is important. They also feel that having information in a graphic organizer helps them "picture" the facts later on science tests. They associate information with the pictures, circles, lines, and other shapes they see when they look at the graphic organizers.
- Students and teachers feel that graphic organizers are a convenient and effective study tool for science tests. Looking at the graphic organizers is not as overwhelming as rereading in the science book.

Recommendations for Further Studies

- To further the study on how graphic organizers effect student retention of scientific facts, the researcher might take a longer period of time to conduct more extensive research, including more carefully scaffolding the idea of graphic organizers. In a longer study, the researcher might have time to take data on how students retain science information after creating their own graphic organizers with pictures, phrases, and colors that match their own thinking process.
- Research might be completed to determine whether graphic organizers help fourth grade students retain science information when completed as a full class, small group, or individually.
- Another study might be conducted to see if, after using graphic organizers, student participation in science discussion increases.

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Appendices

Appendix A

Name [redacted] Date 9/15/04

Teacher [redacted] Grade 4th

Text selected by: ☒ teacher ☐ student

Accuracy Rate 97 Comprehension Level 17 Phrasing and Fluency _____

INTRODUCTION TO THE TEXT: PREVIEWING AND PREDICTING

T: *In this story,* You Don't Look Beautiful to Me, *Mother Skunk thought Little Skunk was beautiful. But the other animals didn't think so. Please read the first five paragraphs aloud to see what you think might happen in this story.*

Student reads the first five paragraphs aloud. If it is an appropriate level, continue with the next question.

T: *What do you think might happen in this story?* → Animals that think they're pretty but that think Little Skunk

Prediction(s) → Animals will hurt Skunks feelings.

Student

- ☐ gathers limited information
- ☒ gathers some information
- ☐ gathers pertinent information
- ☐ predicts next possible event or action
- ☒ predicts several possible events or actions with prompting
- ☐ predicts several possible events or actions without prompting

T: *Now it's time to read and enjoy this story by yourself. When you're done, please come to me and I'll ask you to tell me the important things that happened in the story.*

Student reads the rest of the story silently and then gives a retelling with the book closed.

COMPREHENSION AND RESPONSE

Close the book before the retelling and then say:

T: *Start at the beginning and tell me the important things that happened in this story.*

Highlight or underline information included in the student's retelling on the story overview. Please note the student does not need to use the exact words in order for you to underline the statement, idea, action, or event. Place "TP" by information given in response to a teacher prompt.

Characters: Mother Skunk, Little Skunk, Little Rabbit, Li le Deer, Little Snake
Setting/Places depicted in story: In the forest, on a rock

STORY OVERVIEW

1. Lit le Skunk on rock—Mother Skunk said, You are so beautiful."
2. Little Skunk ran off to talk to his friends.
3. Little Skunk met Little Rabbit—told him what his mother said about his being so beautiful. Rabbit made fun of Little Skunk's long tail and short ears—"You're not beautiful at all."
4. Little Skunk met Little Deer and told him what his mother said. Little Deer said, "You're awfully small and I bet you can't run fast with those short legs. You don't look beautiful to me."
5. Little Skunk met Little Snake—told what his mother said. Little Snake said, "You're much too fat and your skin doesn't have pretty designs on it. You don't look beautiful to me."
6. Little Skunk went home sobbing to Mother Skunk and told her what everyone said. He wanted to know which was better—his legs or Deer's legs, his tail or Rabbit's tail.
7. Mother Skunk said neither. "All animals are beautiful in a different way." Then she helped him understand by having him compare different things—rock and tree.

Ending: Little Skunk understands: "We're all beautiful. Everything in the forest is different and beautiful."

Use one or more of the following prompts to gain further information.

1. *Tell me more.*
2. *What happened at the beginning?*
3. *What happened after* ___(an event mentioned by the student)*?*
4. *Who else was in the story?*
5. *How did the story end?*

Transitioning to different events.

Use these questions only if the following information was omitted from the retelling.

1. *What was Little Skunk's problem?* ← He warned what other people said.
2. *How was Litt e Skunk's problem solved?* → His mom told him each animal is different

Record all other questions asked.

INFERENCE

T: *What did Little Skunk learn?* All animals are different and beautiful.

RESPONSE

T: *Tell me what you liked about this story.* Mother skunk cheered up Little skunk.

T: *What does this story make you think of?*

-Nothing!

MAKING CONNECTIONS

The student links to:

- ☐ personal experience
- ☐ other media or events
- ☐ other literature
- ☒ other No Response

DRA COMPREHENSION RUBRIC

Circle the number to the left of one statement in each row that best describes the student's retelling. Then add the circled numbers together to obtain a total score. Circle the total score (from 6–24) where it appears in the row of numbers at the top of the rubric to determine the level of comprehension.

Very Little Comprehension 6 7 8 9	Some Comprehension 10 11 12 13 14 15	Adequate Comprehension 16 17 18 19 20 21	Very Good Comprehension 22 23 24
1 Tells 1 or 2 events or key facts	2 Tells some of the events or key facts	3 Tells many events, in sequence for the most part, or tells many key facts	4 Tells most events in sequence or tells most key facts
1 Includes few or no important details from text	2 Includes some important details from text	3 Includes many important details from text	4 Includes most important details and key language or vocabulary from text
1 Refers to 1 or 2 characters or topics using pronouns *(he, she, it, they)*	2 Refers to 1 or 2 characters or topics by generic name or label *(boy, girl, dog)*	3 Refers to many characters or topics by name in text *(Ben, Giant, Monkey, Otter)*	4 Refers to all characters or topics by specific name *(Old Ben Bailey, green turtle, Sammy Sosa)*
1 Responds with incorrect information	2 Responds with some misinterpretation	3 Responds with literal interpretation	4 Responds with interpretation that reflects higher-level thinking
1 Provides limited or no response to teacher questions and prompts	2 Provides some response to teacher questions and prompts	3 Provides adequate response to teacher questions and prompts	4 Provides insightful response to teacher questions and prompts
1 Requires many questions or prompts	2 Requires 4–5 questions or prompts	3 Requires 2–3 questions or prompts	4 Requires 1 or no questions or prompts

ORAL READING AND STRATEGIES USED

Record the student's oral reading behaviors on the record of oral reading below, or take a running record on a blank sheet of paper as the student reads page 5. Number the miscues that are not self-corrected.

Page 5

Little Snake crawled curled and uncurled himself while he started stared at Little Skunk. "You're much too fat," he said loudly. "And your skin doesn't have any pretty designs on it. You sure don't look beautiful to me." And he wiggled away.

Little Skunk hurried back to Mother Skunk.

"Oh, mother," he stupid sobbed. "You told me I was beautiful. But Little Rabbit said my tail is was too long, and my ears were too short. Little Deer said my legs should be longer. And Little Snake said I was too fat. I'm not beautiful at all." And he cried harder.

"Of course you are," said Mother Skunk, patting his head.

"Well, which is better," asked longer Little Skunk, "my tail or Little Rabbit's, my legs or Little Deer's?"

"Neither one is better," Mother Skunk said. You "Your tail is right for you, and Little Rabbit's tail is right for him. Your legs are right for you, and Little Deer's are right for him. All of the animals are beautiful. But each is beautiful in a different way."

"How can we all be beautiful if we're different?"

Circle accuracy rate: Word Count 181

96	100	99	98	97	96	95	94	93	92	91	90	89	88
Miscues	0	1–2	3–4	5–6	7–8	9	10–11	12–13	14–15	16–17	18–19	20	21

Phrasing and fluency

Student reads:

- ❑ word by word
- ❑ in short phrases at times
- ☒ in short phrases most of the time
- ❑ in long phrases at times; inconsistent rate
- ❑ in long phrases most of the time; adequate rate
- ❑ in longer phrases; rate adjusted appropriately

Intonation

Student reads with:

- ❑ no intonation; monotone
- ❑ little intonation; rather monotone
- ☒ some intonation; some attention to punctuation; monotone at times
- ❑ adjusts intonation to convey meaning at times; attends to punctuation most of the time
- ❑ adjusts intonation to convey meaning; attends to punctuation
- ❑ begins to explore subtle intonation that reflects mood, pace, and tension

At difficulty

Student problem solves using:

- ❑ picture
- ☒ letter/sound
- ☒ letter sound clusters
- ❑ syllables
- ❑ rereading
- ❑ multiple attempts
- ❑ pausing
- ❑ no observable behaviors

Appealed for help: _____ times

Was told/given: _____ words

Analysis of miscues and self-corrections

Miscues interfered with meaning:

- ❑ no
- ☒ at times sobbed
- ❑ sometimes
- ❑ often

Student:

- ❑ detects no miscues
- ☒ self-corrects a few significant miscues
- ❑ self-corrects some significant miscues
- ❑ self-corrects most significant miscues
- ❑ self-corrects most significant miscues quickly
- ❑ self-corrects all significant miscues quickly

Comments (TB) was reading quickly at making miscues. When he slowed down he made less miscues.

READING PREFERENCES

T: *When do you like to read? Why?*
When I'm bored; Gives me something to do.

T: *Tell how you choose a book to read.*
-Look on back of books.

T: *What is one of your favorite books? Why?*
Magic Tree House; The are Adventures.

Circle the statements on the DRA Continuum that best describe the student's observable reading behaviors and responses.

Appendix B

Examples of non-living parts of an ecosystem:

1) _____
2) _____
3) _____

Examples of living parts of an ecosystem:

1) _____
2) _____
3) _____

An _____ is all the living and _____ things in an _____ and how they interact.

A habitat is a place where an _____ or a _____.

_____ are important because they _____ the needs of animals or plants.

Animals and _____ are part of an ecosystem.

Habitats provide:

1) _____
2) _____
3) _____

They _____, or work together.

Chapter 3 Lesson 1
What is an Ecosystem?

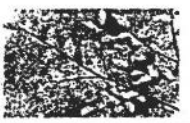
Chapter 3 Lesson 2
How Do Plants Get Energy?

Plants get the energy they need from the _____.

_____ is the green substance in _____ that traps _____ from the sun and gives plants their _____ color.

Plants need _____ and _____ to change light energy into _____ _____.

The _____ of a leaf bring water and _____ to the leaf.



Plants use a special gas in the air called _____ _____.

The gas gets in and out the leaf through _____ holes in the _____ of the leaf. The gas that leaves the leaf is called _____.

Plants make _____ from the sun, carbon dioxide, and _____. This is called photosynthesis.

_____ _____ is the process plants use to change _____ _____ from the sun to make _____. Oxygen _____ the leaf when the plant makes _____.

Plants are different from most other _____ _____.

This is because plants use light to make _____. They are called _____, because they use _____ to make sugar.

Plants use the sugar they make along with _____ to make these plant parts:

1.) _____
2.) _____
3.) _____

Both of these plants are foods we eat with energy stored in them:

1.) _____
2.) _____

Consumers are:

Here is an example of a consumer:

Consumers are different from producers because:

Herbivore:

Carnivore:

Omnivore:

In this box, draw a quick picture of an herbivore, carnivore, or omnivore. Write a sentence describing the things it eats.

Scavenger:

Example:

Decomposer:

Example:

Chapter 3 Lesson 3

How do other living things get energy?

A _____ _____ is the flow of energy through a community.

Predators are:

_____

_____

_____

Prey is:

_____

_____

_____

Chapter 3 Lesson 4
What are food chains and food webs?

A **food web** is:

_____

_____

_____

I can find a good example of a food web on page _____

Use the food chain on pages A82-A83 to fill in the circles:

A food web contains both _____ and _____. Each animal's survival depends on the _____ of other _____ in the food web.

Here are some examples of ways people can affect a food web:

1. _____
2. _____
3. _____
4. _____

Name _____ Date _____ Chapter 3 Assessment A

Reviewing Science Concepts: Multiple Choice

Circle the letter of the answer that best completes the statement or answers the question.

1. Which of the following could be a nonliving part of an ecosystem?
   a. sunlight
   b. the moon
   c. a spider
   d. a tree

2. All animals and plants live in a
   a. biology.
   b. lichen.
   c. planet.
   d. habitat.

3. Plants get the energy they need from the
   a. air.
   b. sun.
   c. food they eat.
   d. minerals in the soil.

4. In what part of a plant is light energy changed into energy the plant can use?
   a. in the roots
   b. in the fruits
   c. in the flowers
   d. in the leaves

5. What color is chlorophyll?
   a. It has no color of its own.
   b. yellow
   c. green
   d. brown

6. During photosynthesis, a plant produces all of the following EXCEPT
   a. sugar.
   b. carbon dioxide.
   c. oxygen.
   d. water.

7. How does a deer get the energy it needs to survive?
   a. by making sugars from sunlight
   b. by eating plants
   c. by eating other animals
   d. by breaking down the bodies of dead plants and animals

8. If an animal is an herbivore, then you know about
   a. what the animal eats.
   b. where the animal lives.
   c. how the animal reproduces.
   d. how long the animal lives.

9. What happens to an oak leaf that falls to the forest floor?
   a. It melts.
   b. It turns into a new oak tree.
   c. It is broken down by decomposers.
   d. It is eaten by scavengers.

10. Energy is passed from one organism to another in
    a. sunlight.
    b. a food chain.
    c. consumers.
    d. deforestation.

11. In a food web, the organisms at the bottom are usually
    a. producers.
    b. predators.
    c. prey.
    d. carnivores.

12. What might happen in a food web if good weather makes the plant population increase?
    a. The herbivores and carnivores will decrease.
    b. The herbivores will increase and the carnivores will decrease.
    c. The herbivores and the carnivores will increase.
    d. There will be no change.

Name _____ Date _____

Reviewing Main Ideas: Sentence Completion

Complete each sentence with the correct word or phrase.

food chain	loss	sunlight
interact	omnivore	survive

_____ **13.** An ecosystem is all the living and nonliving things in an environment and how they ____.

_____ **14.** Its habitat provides what a plant needs to ____.

_____ **15.** Plants use energy from ____ to produce sugars.

_____ **16.** Animals that eat both plants and other animals are called ____.

_____ **17.** Energy passes from plants to other organisms in a ____.

_____ **18.** The goal of a California monarch butterfly farm is to replace monarchs that were destroyed by habitat ____.

Short Essay Use complete sentences to answer questions 19 and 20.

19. What is a desert habitat like? What would you expect to find there?

_____

_____

_____

20. When something touches a spider's web, the movement is felt everywhere in the web. How is this like a change in a food web?

_____

_____

_____

Appendix C

What structures help plants and animals survive?

An adaptation is:

_____
_____
_____
_____
_____

Plant structures for survival:

- Plants need _____ to live and grow.
- Here are two examples of parts plants use to help them get sunlight:

1) _____ climb towards the sun.
2) _____ have large _____ that capture sunlight.

Plants also need water to survive:

This is how pine trees get water in the winter:_____
_____
_____
_____
_____
_____
_____
_____

- A cactus lives in a very dry environment. This is how the cactus stores water:_____
_____
_____
_____
_____
_____
_____

Animal Structures for Survival:

- Animals need _____, _____, and _____ from their environments to stay _____.
- Some adaptations help animals get _____ or _____.
- Some _____ help animals stay cold or _____.
- Other adaptations keep animals safe from _____.

Examples of animal structures for survival: Use pages A100-A101

- Crabs:_____
_____
_____

- Spiders:_____
_____
_____

- Walruses:_____
_____
_____

Camouflage

- Camouflage is:_____
_____
_____
- Here are three examples of camouflage:

1) _____
2) _____
3) _____

Chapter 4 Section 1

What Behaviors Help Animals Survive?

Why do animals live in groups?_____

How animals work together:

On page A106, there are two examples of how animals work together in groups. Pick one group and describe below:

Caring for young:

- Many animals are _____ at birth and need to be taken care of.
- Adult animals _____ their young from _____.
- The red fox protects her young by:_____
- A kangoroo protects her young with her _____.

Migration

- Migration is:_____
- Here is an example of animal and where it migrates to:_____
- Why does it migrate?_____

Hibernation

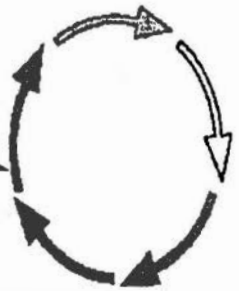
- Hibernation is:_____
- There are two kinds of hibernators:

1) _____

2) _____

Special Ways that Animals Live Together:

- Symbiosis:_____
- Parasite:_____
- Host:_____



Chapter 4

Section 3: How Do Changes in the Environment Affect Survival?

Pollution is:

Recycling is:

It is caused by:

Here are some ways we can protect the our Earth:

Here are some things we can recycle:

Land:

Air:

Water:

1.)

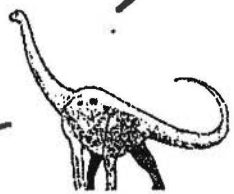
2.)

1.)

2.)

3.)

Extinction happens naturally when: _____



Extinct:

Extinction is also caused when habitats are destroyed by people. These are ways people have destroyed habitats:

1.) _____

2.) _____

3.) _____

Endangered:

_____

_____

_____

Chapter 4 Lesson 4: Do plants and animals always survive?

A fossil is:

_____

_____

_____

This is what scientists learn from fossils:

1.) _____

_____

2.) _____

_____

Name _____ Date _____

Chapter 4 Assessment A

Reviewing Main Ideas: Multiple Choice

Circle the letter of the answer that best completes the statement or answers the question.

1. What is the purpose of adaptation?
   a. To help a living thing survive
   b. To balance an ecosystem
   c. To help living things reproduce
   d. To make sure young are cared for

2. Why does a cactus plant have long, shallow roots that cover a wide area?
   a. To spread new cactus plants
   b. To absorb water quickly
   c. To keep the plant cool
   d. To keep moisture inside the plant

3. Camouflage helps animals survive by helping them
   a. keep their body heat.
   b. produce young.
   c. hide in their surroundings.
   d. get minerals in the soil.

4. How do lions benefit from living in a pride?
   a. Working as a group makes it easier to get food.
   b. Because they are in a group, the lions don't get lonely.
   c. It is easier for them to protect themselves from predators.
   d. The older lions know where to go to find food sources.

5. One way that birds care for their young is by
   a. teaching them how to hunt.
   b. picking fleas out of their feathers.
   c. camouflaging them.
   d. bringing them food.

6. What kind of symbiosis occurs between a cat and a flea?
   a. Both animals benefit.
   b. The cat benefits and the flea is harmed.
   c. The flea benefits and the cat is harmed.
   d. The flea benefits, and the cat neither benefits nor is harmed.

7. Adding harmful material to the environment is called
   a. pollution. c. extinction.
   b. adaptation. d. disease.

8. What effect does litter have on animals?
   a. It gives them something new to eat.
   b. It harms them by causing injuries.
   c. It makes them leave their habitat.
   d. It has no effect.

9. Which of the following is a way that people can help protect the environment?
   a. Bring their garbage to open dumps
   b. Ride in cars instead of on bicycles
   c. Throw bottles and cans onto the ground
   d. Take part in car pools

Name _____ Date _____

Reviewing Concepts: Matching Words and Meanings

Match each description with the correct word.

endangered	extinct	migration	hibernation	habitat loss
adaptation	camouflage	pollution	litter	fossils

_____ **10.** The Tasmanian wolf has disappeared completely.

_____ **11.** Scientists study the plants and animals of long ago to learn about Earth.

_____ **12.** More animals are becoming endangered because their food and shelter are destroyed by development.

_____ **13.** A polar bear has a thick layer of blubber.

_____ **14.** A bark mantis is barely visible against the tree it clings to.

_____ **15.** Millions of monarch butterflies travel from the Northern United States to areas in California and New Mexico.

_____ **16.** A ground squirrel stays in a deep sleep for the whole winter.

_____ **17.** Coal-burning power plants release harmful chemicals in the air.

_____ **18.** The African violet can now be found only in a few forests in Tanzania, Africa.

Short Essay Use complete sentences to answer questions 19 and 20.

19. Give an example of an adaptation that is a behavior.

_____

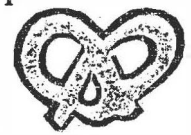
20. How might an environmental change affect an animal's migration?

_____

_____

Appendix D

Chapter 4 Lesson 1



What is Matter?

Matter is anything that:_____

_____.

Mass is:

_____

_____

_____.

Volume is:

_____

_____

In the book, the thinner pretzel has less mass than the thicker pretzel because

_____

_____

The thinner pretzel also takes up less _____. It has less _____.

The difference between mass and volume is_____

_____

_____

A property is:

_____

_____.

The three states of matter are _____, _____, and _____.

A solid has a _____ and _____ of its own.
A _____ takes the _____ of its container.
A gas does not have a _____ or a _____ of its own.

A mixture is:_____

_____

Here is an example of a mixture: _____

A solution is:_____

_____

Here is an example of a solution: _____

Name _____ Date _____

Assessment
Chapter 1 Lesson 1

Reviewing Science Concepts: Multiple Choice

Circle the letter of the answer that best completes the statement or answers the question.

1. Matter is anything that
   - **a.** is heavier than air.
   - **b.** floats on water.
   - **c.** has weight and takes up space.
2. The amount of material that an object has in it is the object's
   - **a.** mass. **b.** energy. **c.** volume.
3. An example of changing the volume of a material is
   - **a.** freezing the water in a glass.
   - **b.** pouring water into a bigger glass.
   - **c.** pouring some of the water out of a glass.
4. A liquid is a kind of matter that has
   - **a.** a volume and shape of its own.
   - **b.** a volume but no shape of its own.
   - **c.** a shape but no volume of its own.
5. If you say that a drink is red and fizzy, you are describing its
   - **a.** volume. **c.** properties.
   - **b.** density.
6. An example of a gas is the
   - **a.** helium inside a balloon.
   - **b.** ice in your soda.
   - **c.** mass of a car.
7. You are creating a mixture when you
   - **a.** put chocolate syrup in your milk.
   - **b.** add sugar to tea or coffee.
   - **c.** make a fruit salad.
8. A solution is a mixture in which
   - **a.** one substance spreads evenly throughout the other.
   - **b.** one subatance is a gas and another is a solid.
   - **c.** the two substances can be easily separated.
9. You are creating a solution when you
   - **a.** put ice in your soda.
   - **b.** put chocolate syrup in your milk.
   - **c.** make a potato salad.

Applying Strategies: Exploring Mass

Use complete sentences to answer question 10.

10. Which would you estimate has the greater mass—a two-inch feather or a one-inch eraser?

_____

_____

_____

Appendix E

Chapter 4 Lesson 2

How are length and volume measured?

Length measures the _____ from one _____ to another.

The standard system of measurement is called the _____ _____.

A unit for measuring length is the _____.

The symbol for meter is _____.

Prefixes for meter:

Centi- means _____	Centimeter (_____) is _____ of a meter
milli- means _____	Millimeter (_____) is _____ of a meter
kilo- means _____	Kilometer (_____) is _____ of a meter

A _____ _____ is a unit for measuring the _____ of a solid. To find the volume of a box, multiply _____ x _____ x _____.

A _____ is a unit for measuring _____ of a liquid. The symbol for liter is _____.

Graduated cylinder:

_____

_____

A graduated cylinder can be used to measure the volume of an object that has irregular _____, _____, and _____.

Explain how to use a graduated cylinder to measure volume:

_____

_____

_____

_____

_____

_____

Name _____ Date _____

Reviewing Terms: Matching

Match each description with the correct word or phrase.

_____ **1.** basic unit of measurement
_____ **2.** $\frac{1}{100}$ of a meter
_____ **3.** 1,000 meters
_____ **4.** $\frac{1}{1,000}$ of a meter
_____ **5.** unit for measuring the volume of a liquid
_____ **6.** scientist's tool for measuring liquids

a. centimeter
b. meter
c. millimeter
d. graduated cylinder
e. liter
f. kilometer
g. milligram

Reviewing Concepts: Sentence Completion

Fill in the blank in each sentence. Use metric terms.

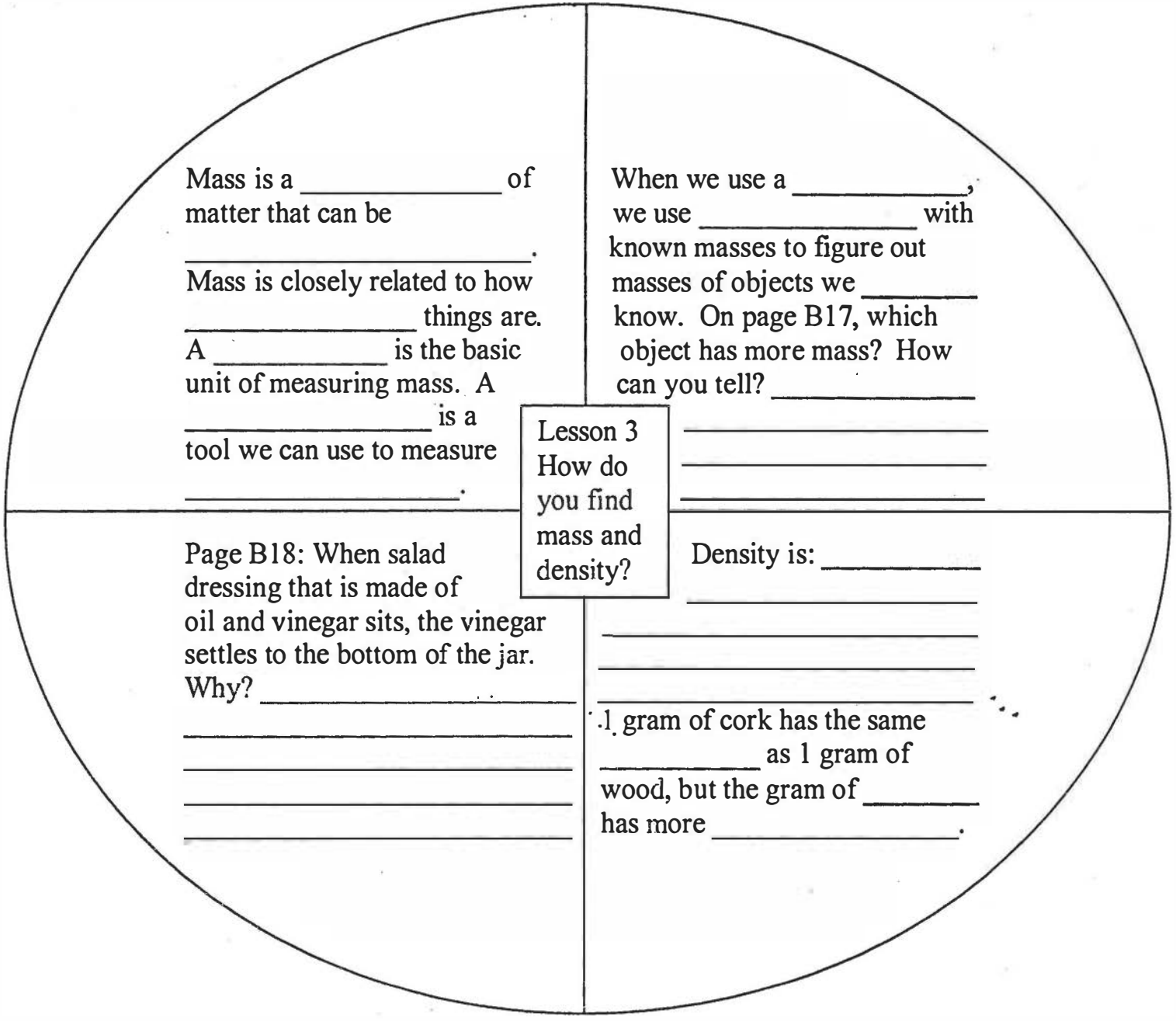
7. You should measure the volume of a room in _____.
8. You should measure the amount of liquid in a teaspoon in _____.
9. You should measure the distance between two cities in _____.

Applying Strategies: Exploring Mass

Use complete sentences to answer question 10.

10. Is the mass of a cup of water greater than or less than a cup of sand?

Appendix F


Mass is a _____ of matter that can be _____.
Mass is closely related to how _____ things are. A _____ is the basic unit of measuring mass. A _____ is a tool we can use to measure _____.
When we use a _____, we use _____ with known masses to figure out masses of objects we _____ know. On page B17, which object has more mass? How can you tell? _____
Lesson 3 How do you find mass and density?
Page B18: When salad dressing that is made of oil and vinegar sits, the vinegar settles to the bottom of the jar. Why? _____
Density is: _____
1 gram of cork has the same _____ as 1 gram of wood, but the gram of _____ has more _____.

Reviewing Science Concepts: Multiple Choice

Circle the letter of the best answer.

1. Mass is most closely related to an object's
   a. weight. **b.** size. **c.** shape. **d.** temperature.
2. Which unit should you use to measure the mass of a person?
   a. milligram **b.** gram **c.** kilogram **d.** milliliter
3. To measure an object's mass, you would use a
   a. graduated cylinder. **c.** measuring spoon.
   b. meter stick. **d.** balance.
4. Which substance would be measured in milligrams?
   a. rocks **b.** medicine **c.** gasoline **d.** coal
5. Density is defined as the
   a. amount of mass in a certain volume.
   b. size and shape of an object.
   c. amount of liquid mixed with another liquid.
   d. height of an object divided by its width.
6. The oil and vinegar in a salad dressing separate because they have different
   a. shapes. **b.** sizes. **c.** densities. **d.** volumes.

Reviewing Concepts: Sentence Completion

Fill in the blank in each sentence.

7. A rock and a piece of foam rubber are the same size, but the rock is heavier. You could say that it has greater _____.
8. You should measure the mass of a pencil in _____.
9. You pour two liquids into a container. If one liquid floats on top of the other, you know that it is _____.

Applying Strategies: Exploring Mass

Use complete sentences to answer question 10.

10. Which would you estimate has the lesser mass—a lemon or a grapefruit?

_____

_____

Appendix G

A physical change is:

_____

_____

_____

Here is an example:

_____

_____

Another way to change matter is by _____ or _____ it.

Melting point:

_____

_____

_____

Boiling point:

_____

_____

_____

Freezing point:_____

_____

_____

Name _____ Date _____

Reviewing Terms: Sentence Completion

Fill in the blank in each sentence.

boiling point	physical
melting point	physical properties

1. The temperature at which matter changes from a solid to a liquid is called the _____.
2. The temperature at which matter changes from a liquid to a gas is called its _____.
3. If you flatten a piece of clay, you have made a _____ change.
4. A physical change is a change in an object's _____.

Reviewing Main Ideas: True or False

Write **T** (True) or **F** (False) on the line before each statement.

_____ **5.** A physical change can change an object into a different kind of matter.

_____ **6.** Cutting a sheet of paper into tiny pieces is an example of a physical change.

_____ **7.** For melting or boiling to occur, energy is needed.

_____ **8.** When water boils, the tiny particles it is made of move closer together.

_____ **9.** For water to cool to its freezing point, it must gain energy.

Applying Strategies: Exploring Mass

Use complete sentences to answer question 10.

10. Which would you estimate has the greater mass—a five-inch banana or a seven-inch banana?

Appendix H

A chemical change is:_____

_____

_____

A chemical change is different from a physical change because:_____

_____

_____

_____

There are three chemical changes that take place when you make and eat pancakes:

1) _____

_____

_____

2) _____

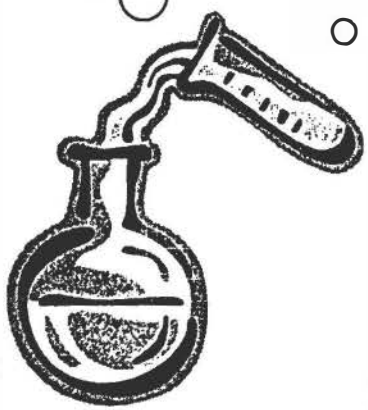
_____

_____

3) _____

_____

_____



Other examples of chemical changes are:

1) _____
2) _____
3) _____

Name three other examples of a chemical change:

1) _____
2) _____
3) _____

Lesson 5---What are Chemical Changes?

Reviewing Concepts: Sentence Completion

Fill in the blank in each sentence.

burning	rust
chemical	tarnished

1. A _____ change in matter results in a different kind of matter.
2. The material that forms when iron joins with oxygen from the air is _____.
3. An explosion is a very fast kind of _____.
4. A silver spoon will look black when it is _____.

Reviewing Main Ideas: True or False

Write **T** (True) or **F** (False) on the line before each statement.

_____ 5. When you eat and digest food, only physical changes take place.

_____ 6. Pancakes become brown and spongy because of chemical changes.

_____ 7. Your body gets energy from food through a chemical change.

_____ 8. An explosion is an example of a physical change.

_____ 9. A chemical change produces a different kind of matter.

Applying Strategies: Exploring Mass

Use complete sentences to answer question 10.

10. Which would you estimate has the greater mass—a box of facial tissues or the same-sized box of crayons?

Appendix I

Student Code: _____

Date:_____

Graphic Organizer Survey: Circle the phrase that tells how you feel about each statement.

1) Graphic organizers help make the science information easier to remember.

- Yes, they always make information easier to remember.
- They sometimes make information easier to remember.
- No, they never make information easier to remember.

2) Graphic organizers help me study for the science chapter tests.

- Yes, the graphic organizers always help me study for tests.
- The graphic organizers sometimes help me study for tests.
- No, the graphic organizers never help me study for tests.

3) When I use graphic organizers, I feel more confident about taking science tests.

- Yes, the graphic organizers always make me feel more confident about taking science tests.
- The graphic organizers sometimes make me feel more confident about taking science tests.
- No, the graphic organizers never make me feel more confident when taking science tests.

Appendix J

Graphic Organizer Student Interview Questions

1. Do you think graphic organizers make science information easier to understand? Why or why not?

2. Do you think graphic organizers make science information easier to remember? Why or why not?

3. Why do you like or not like graphic organizers?

4. Do graphic organizers make it seem harder or less hard to study for a test? Why or why not?

5. Do graphic organizers make learning more fun? Why or why not?

Appendix K

Graphic Organizer Teacher Survey

Please read each statement and circle the bullet that best applies to your classroom practice. Thank you again for your time!

I teach grade: _____

1) I use graphic organizers in my classroom
   - Often
   - Sometimes
   - Never

2) When I use graphic organizers, I find that my students
   - Seem to clearly understand information on the organizers
   - Sometimes clearly understand information on the organizers
   - Rarely understand information on the organizers

3) I use graphic organizers most often in (circle all applicable)
   - ELA
   - Math
   - Social Studies
   - Science

4) Do you have any more quick thoughts on graphic organizers? Use the lines below to tell me what you think!

_____

_____

_____

_____

_____

_____