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**Let's see the facts: The effects of text mapping
on comprehension and visual representation
of expository text with fourth-grade students**

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LET'S SEE THE FACTS: THE EFFECTS OF TEXT MAPPING ON COMPREHENSION
AND VISUAL REPRESENTATION OF EXPOSITORY TEXT WITH FOURTH-GRADE
STUDENTS

A Thesis by

Kelly Palmer

Bachelor of Science, Northeastern State University, 2009

Submitted to the Department of Curriculum and Instruction
and the faculty of the Graduate School of
Wichita State University
in partial fulfillment of
the requirements for the degree of
Master of Education

May 2013

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AND VISUAL REPRESENTATION OF EXPOSITORY TEXT WITH FOURTH-GRADE
STUDENTS

The following faculty members have examined the final copy of this thesis (or dissertation) for form and content, and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Education with a major in Curriculum and Instruction.

Kim McDowell, Committee Chair

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Ashlie Jack, Committee Member

Marlene Schommer-Aikins, Committee Member

DEDICATION

To my parents for the tremendous amount of emotional, physical, and financial support you have provided over the last twenty-five years. I couldn't, and wouldn't, have done this without you.

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I must first acknowledge my wonderful fourth-grade students. For the past year, they have allowed me to challenge them and try new things in the classroom. I appreciate their positive, can-do attitude and willingness to be my guinea pigs.

I must also recognize my committee members. Dr. McDowell, Dr. Jack, and Dr. Schommer-Aikins helped remind me that learning is a life-long process. Although constructive criticism can sting at times, it is part of the educational journey and has made the outcome of my labor better. A special thanks must go out to my final committee member, Dr. Carroll. She has spent the last two years of my graduate education counseling, correcting, and calming nerves.

A final thank you goes out to my WSU cohort group. It was a pleasure learning from this group of outstanding educators each week. We did it together; congratulations!

ABSTRACT

Despite the importance of expository text in the daily lives of students and adults, the amount of time actually devoted to explicit comprehension instruction of nonfiction text is often not enough for students to gain an adequate understanding of the material, especially when asked to represent their learning in a variety of ways. The intention of this research was to examine how direct instruction in the PLAN text-mapping strategy would affect student comprehension and the ability to represent information visually for both on-level and below-level learners. Forty-four, fourth-grade students were assessed on their comprehension and graphic representation abilities prior to PLAN instruction. They then received instruction using PLAN to map expository lessons. Results showed that most students achieved higher comprehension gains when being instructed with the PLAN strategy as compared to reading without text mapping. Multiple aspects of their visual representations also showed improvement through the use of PLAN.

Keywords: reading, expository, PLAN, text map, visual representation

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CHAPTER 1

INTRODUCTION

With the adoption of the Common Core State Standards (CCSS, 2010) in forty-five states, many teachers are preparing for an enormous shift in their approach to instruction in their classrooms. The standards were designed to be rigorous, require deeper thinking skills, and prepare students for college and career readiness after their formal education. The National Governors Association Center for Best Practices (NGA Center) and Council of Chief State School Officers (CCSSO) created the CCSS in the areas of mathematics and English/language arts (ELA). The ELA standards for kindergarten through fifth grade include, but are not limited to, standards for literature, informational text, reading foundational skills, writing, speaking and listening, and language (NGA Center & CCSSO, 2010).

As previously mentioned, one area of focus for the new ELA standards is the use of informational text. Previous state standards have required exposure to and instruction of expository text in the classroom. However, the CCSS more thoroughly speak to the depth of knowledge students are expected to possess and contain greater requirements for application of that knowledge. Grade specific reading standards for information text correspond to the College and Career Readiness Anchor Standards addressing key ideas and details, craft and structure, integration of knowledge and ideas, and range of reading and level of text complexity (NGA Center & CCSSO, 2010). When conveying gleaned information, Writing Standards and Speaking and Listening Standards under Common Core require that students are able to communicate information through written and oral presentation, including the use of visual information. The CCSS have also aligned with the framework for the National Assessment of Education Progress (NAEP) requiring that students have increased exposure

to the reading of informational texts in all classrooms (Gewertz, 2012).

Fortunately for classroom teachers, a new focus on informational text extends beyond instructional standards. Even prior to the release of the final CCSS in 2010, there had been a marked increase in the number and quality of informational texts made available for young children during recent years (Cummins & Stallmeyer-Gerard, 2011, p. 394; Donahue, 1990, as cited in Martinez & McGee, 2000, p. 162). Since the adoption of the CCSS across America, many districts have realized that the current programs and materials used in classrooms do not contain a sufficient amount of expository text in alignment with the NAEP framework. Educational publishing companies, such as Pearson and Scholastic Education, are responding to the demand for more informational text by revising old programs and creating entirely new ones to achieve a greater balance between fiction and nonfiction in the classroom (Gewertz, 2012). The advancements in informational text are making nonfiction more accessible in the classroom than ever before.

On the journey to achieving the Common Core classroom, educators have already made many preparations. The standards put forth together by the NGA Center and the CCSSO provide teachers with a starting point and a vision of the destination for their students. The standards state what children are entering the classroom with from the previous grade level. Teachers then build upon their prior knowledge to ensure students meet the outlined standards at the end of their year-long expedition. School districts and publishing companies have also taken initiative to modify current curriculum to make sure teachers' suitcases are packed with the necessary materials to implement the standards in the classroom. Despite these arrangements having been made for the trip to Common Core achievement, an itinerary is far from being ready. The CCSS specifically states that while it defines what students are to achieve, it does not provide teachers with the means for reaching these goals. Educators are then left with the daunting task of determining instructional

practices that will assist their students in meeting the standards. Teachers will have to investigate whether methods previously employed will meet the rigorous demands of the CCSS.

This study examined the following questions:

1. How does the use of the PLAN text-mapping strategy impact comprehension of expository text with fourth-grade students?
2. How does PLAN impact students reading at below grade level versus on-level students?
3. How does using PLAN affect students' ability to create visual representations of expository text?

CHAPTER 2

REVIEW OF THE LITERATURE

Literacy in the twenty-first century is more complex than ever. It requires people to not only read and communicate written word, but to present, create visual information, and use innovative technologies (International Reading Association/National Council of Teachers of English, 1996, as cited in Norman, 2012, p. 740; The New London Group, 1996, as cited in Norman, 2012, p. 740). One major component of literacy proficiency is the ability to comprehend and communicate information gained through the reading of nonfiction text. The benefits of exposure to and instruction of informational texts are visible even at the primary and elementary level. Early instruction in expository text can motivate young children to read, as it satisfies their curiosities and helps them become more knowledgeable about the world around them (Duke, 2000, p. 202; Maloch, 2008, p. 316). In addition to motivating students, nonfiction texts also expose students to new words and concepts, increasing their vocabulary and content knowledge (Hall & Sabey, 2007, p. 262; Yopp & Yopp, 2004, p. 82). Work by Duke and Kays (1998) also suggested that even before students are old enough to read independently, they can produce features found in informational books in pretend readings when exposed to nonfiction (as cited in Duke, 2000, p. 206). This implies that early experience in expository text can aid students in their oral and written communication of information in the future (Duke, 2000, p. 207; Risko, Walker-Dalhouse, Bridges, & Wilson, 2011, p. 378). Scholars also believe early instruction of expository text has future implications in the area of comprehension. Despite the complexity of comprehending nonfiction at a young age, researchers support exposure to informational text during primary and elementary years as a way to alleviate future difficulties with this genre (Fisher, Flood, & Lapp, 1999, as cited in Barton & Sawyer, 2003/2004, p. 335; Snow, Burns, & Griffin, 1998,

as cited in Barton & Sawyer, 2003/2004, p. 335; Fisher, 2009; Maloch, 2008, p. 316; Duke, 1998, as cited in Martinez & McGee, 2000, p. 167).

The importance of instruction in nonfiction intensifies as children transition into middle school and high school. As students deepen their studies in a variety of content areas, comprehension of informational texts becomes central to gaining new knowledge (Duke, 2000, p. 222; Smagorinsky, 2001, as cited in Hagaman & Reid, 2008, p. 222; Craig & Yore, 1996, as cited in Smith, Holliday, & Austin, 2010, p. 363; Shanahan, 2004, as cited in Smith et al., 2010, p. 363). According to Moss (2004), more than 75% of reading in sixth grade is through the use of informational text (as cited in Hall & Sabey, 2007, p. 261). The NAEP framework also increases the amount of informational passages to 55% in eighth grade and 70% by twelfth grade (Gewertz, 2012).

Nonfiction comprehension skills continue to play an important role as students progress from secondary to post-secondary learning institutions. Caverly, Orlando, and Mullen (2000) found that college professors require a substantial amount of informational reading be done by their students (as cited in Smith et al., 2010, p. 364). Students who are successful at comprehending this material are generally able to make inferences about, communicate, and apply information without having to reproduce the text verbatim (Norris & Phillips, 1994, as cited in Smith et al., 2010, p. 364).

The same is true as students complete their education and enter professional careers. As Duke (2000) stated, it is essential that employees are able to comprehend, compose, and locate information in their daily lives if they are to be successful. The Internet is widely used in American businesses and homes, and over ninety percent of text on the Internet is nonfiction (Kamil & Lane, 1998, as cited in Hall & Sabey, 2007, p. 261). Informational texts constitute a majority of what adults encounter at work and at home, and adults must possess the necessary skills to understand what they are reading (Venezsky, 2000, as cited in Hall &

Sabey, 2007, p. 261). Effective instruction of informational texts benefits students throughout their educational careers and adult lives.

Despite understanding the importance of nonfiction instruction, educational institutions in the United States have a long-standing history of inadequately exposing students to informational text. Based on research conducted by Martinez and McGee (2000, p. 157), basal readers through the 1950s narrowly focused on narrative text and changed little during the latter part of the century. During this time, it was widely accepted that instruction in narrative text must precede instruction in expository text (Maloch, 2008). Despite changes in this belief, the deficiency of informational text found in school reading series is unfortunately still present in many classrooms (Hoffman et al., 1994, as cited in Duke, 2000, p. 205; Moss & Newton, 1998, as cited in Duke, 2000, p. 205; Moss & Newton, 2002, as cited in Fisher, 2009). The disproportionate amount of time spent with expository text versus narrative text begins in primary grades and extends beyond basal readers (Duke, 2000, p. 212; Duke, 2000, as cited in Yopp & Yopp, 2004, p. 82; Yopp & Yopp, 2000, as cited in Yopp & Yopp, 2004, p. 82). In research conducted in a first-grade classroom, Duke (2000, p. 212) found that little informational text could be found on classroom displays, in classroom libraries, or during classroom activities. The study also revealed that in the observed classrooms, an average of only a few minutes each day was devoted to the use of nonfiction texts. This scarcity of experience is one factor contributing to the difficulties students have when reading expository text (Fisher, 2009; Martinez & McGee, 2000, p. 167).

Even when students are given opportunities to interact with informational text in the classroom, the experiences are often ineffectively supported. According to Pressley & Wharton-McDonald (2006), most successful comprehension instruction in primary and elementary classrooms centers around narrative text (as cited in Smith et al., 2010, p. 364). With such a solid focus on teaching narrative strategies, many teachers are failing to provide

students with the comprehension skills necessary to understand expository text (Applebee, Langer, Mullis, Latham, & Gentile, 1994, as cited in Duke, 2000, p. 202; Daniels, 1990, as cited in Duke, 2000, p. 202; Langer, Applebee, Mullis, & Foertsch, 1990, as cited in Duke, 2000, p. 202; Alfassi, 2004, as cited in Hagaman & Reid, 2008, p.223). Students are often inexperienced with the unique features and structures of informational text, and therefore, have difficulty drawing out important pieces of information (Rapp, van der Broek, McMaster, Kendeou, & Espin, 2007, as cited in Bluestein, 2010, p. 597; Kaganoff & Spencer, 1991, as cited in Spencer, 2003, p. 752; Peacock, 1997, as cited in Spencer, 2003, p. 752). Many educators find it difficult for students to independently use strategies that address these issues (Reid & Lienemann, 2006, as cited in Hagaman & Reid, 2008, p. 223; Williams, 2002, as cited in Hagaman & Reid, 2008, p. 223) and end up doing much of the comprehending for them to alleviate cognitive overload (Maloch, 2008, p. 318). The result is that educators find their classrooms brimming with students incapable of using strategies to think about what they are taking in and applying information independent from a direct instruction safety net (Caverly, Mandeville, & Nicholson, 1995, p. 190).

These issues are especially evident in fourth-grade students. Researchers have discovered a general achievement decline in reading at the fourth-grade level. According to the National Center for Education Statistics (2004), the NAEP reported that two thirds of fourth-grade students are not reading proficiently at grade level (as cited in Hagaman & Reid, 2008, p. 222). There is a significant shift in the amount of informational reading required in fourth grade, which may help to explain the number of students struggling with reading at that level (Chall, Jacobs, and Baldwin, 1990, as cited in Duke, 2000, p. 202). Regrettably, this issue only exacerbates as students enter middle school. The amount of informational text students are required to read both in and outside of ELA courses only increases as students advance to higher grades. Even among proficient middle-school readers, students

comprehend expository text a grade-level lower than they do narrative text (Fisher, 2009). Research suggests that difficulty comprehending informational text extends even beyond high school into the university level. Callender & McDaniel (2007) and Caverly et al. (2000) both noted that college students have difficulty reading much of their course material because it is packed with technical information (as cited in Smith et al., 2010, p. 363). Despite this predicament being evident, college professors often do not have the time or training to provide students with comprehension strategies for reading course texts (Smith et al., 2010, p. 365). University instructors and even employers recognize the inability of many adults to comprehend informational text central to their areas of study and work (Gewertz, 2012). This is one of the reasons the NGA Center and CCSSO call for expository instruction in elementary grades. Hopefully through a strong emphasis on nonfiction text in the CCSS, schools will begin to produce students capable of meeting the informational challenges of post-secondary education and beyond.

The first step in meeting these challenges is arming students with basic skills they must utilize to comprehend all forms of text. Research has recognized that comprehension takes place before, during, and after reading of text (Caverly et al., 1995, p. 190; Gagne, 1985, as cited in Tasdemir, 2010, p. 554; Vacca, 1981, as cited in Tasdemir, 2010, p. 554; Vacca & Vacca, as cited in Tasdemir, 2010, p. 554). Different strategies can be utilized during these three stages to aid in comprehension. Both schema theory and cognitive theory support the use of background knowledge prior to reading text (Graves, Juel, & Graves, 2001, as cited in Barton & Sawyer, 2003/2004, p. 334; Rumelhart, 1980, as cited in Barton & Sawyer, 2003/2004, p. 334; Anderson & Person, 1984, as cited in Caverly et al., 1995, p. 191). Activating prior knowledge aids students in a variety of ways. It first helps bridge the gap between what students already know and what information is found in the text (Anderson & Pearson, 1984, as cited in Barton & Sawyer, 2003/2004, p. 335; Bransford, Brown, &

Cocking, 1999, as cited in Barton & Sawyer, 2003/2004, p. 335; Hudson & Slackman, 1990, as cited in Barton & Sawyer, 2003/2004, p. 335; Dymock & Nicholson, 2010, p. 176).

Additionally, it can help students focus on the topic to be discussed and understand the purpose for reading (Duke, 2005, as cited in Norman, 2012, p. 741; RAND Reading Study Group, 2002, as cited in Norman, 2012, p. 741). Utilizing background knowledge also helps students make predictions and generate questions, both pre and during-reading strategies (Cain, Oakhill, Barnes, & Bryant, 2001, as cited in Coiro & Dobler, 2007, p. 217; Pearson, Roehler, Dole, & Duffy, 1992, as cited in Coiro & Dobler, 2007, p. 217; Bransford, Stein, Vye, Franks, Auble, Mezynski, & Perfetto, 1982, as cited in Smith et al., 2010, p. 365; Levin, 2008, as cited in Smith et al., 2010, p. 365). Predicting can involve guessing the structure of the text, included vocabulary, and future events (Barton & Sawyer, 2003/2004, p. 337; Palincsar & Brown, 1984, as cited in Smith et al., 2010, p. 265; Yopp & Yopp, 2004, p. 81).

Proficient readers constantly interact with text as they read. Creating and answering questions can help students self-monitor their understanding of what they are reading (Block & Parris, 2008, as cited in Dymock & Nicholson, 2010, p. 167; Block & Pressley, 2007, as cited in Dymock & Nicholson, 2010, p. 167; Dymock & Nicholson, 1999, as cited in Dymock & Nicholson, 2010, p. 167; National Institute of Child Health and Human Development (NICHD), 2000, as cited in Dymock & Nicholson, 2010, p. 167; Shapiro & Cole, 1994, as cited in Jitendra, Hoppes, & Xin, 2000, p. 127; Lapp, Fisher, & Johnson, 2010, p. 425).

Studies also support the creation of visual structures both during and after reading to aid in comprehension (Taylor & Beach, 1984, as cited in Caverly et al., 1995, p. 191; Pressley, 2002, as cited in Dymock & Nicholson, 2010, p. 171). Creating visual images helps readers physically organize information in a way that is easier to recall (Alvermann & Boothby, 1986, as cited in Barton & Sawyer, 2003/2004, p. 337; Calfee & Patrick, 1995, as cited in Barton & Sawyer, 2003/2004, p. 337; Norton, 1992, as cited in Barton & Sawyer, 2003/2004,

p. 337). As a final step, scholars suggest the use of a post-reading strategy where students respond to what they have read. Through summarizing, identifying the main idea, discussing, or, as previously mentioned, creating a graphical representation of the text (Beach, 1993, as cited in Barton & Sawyer, 2003/2004, p. 336; Guthrie & Anderson, 1999, as cited in Barton & Sawyer, 2003/2004, p. 336; Barton & Sawyer, 2003/2004, p. 337; Birnbaum, 1986, as cited in Caverly et al., 1995, p. 191; Keene & Zimmermann, 2007, as cited in Cummins & Stallmeyer-Gereard, 2011, p. 395; Calfee & Patrick, 1995, as cited in Dymock & Nicholson, 2010, p. 172; NICHD, 2000, as cited in Dymock & Nicholson, 2010, p. 172; Hagaman & Reid, 2008, p. 223). Through explicit instruction of research-based strategies, students will have basic skills to draw from when comprehending a variety of text.

Despite the fact that many strategies cross genre boundaries, there are notable differences between fiction and nonfiction texts that can increase the difficulty students have comprehend the latter text form. Since narrative texts are predominating in so many elementary classrooms, teachers must understand how expository texts differ in order to begin effectively using them in the classroom. Differences in expository text include the following: (a) multiple text features, (b) variety of text structures, and (c) content-related vocabulary. Informational texts can employ a staggering number of features not often found in narrative text. Just some of the features common to expository text include headings and subheadings, tables of contents, indexes, glossaries, captions, and visual representations (Moss, 2005, as cited in Bluestein, 2010, p. 597; Fisher, 2009; Hall & Sabey, 2007, p. 262). The term visual representations broadly speaks to a variety of ways authors choose to share information including, but not limited to, graphs, illustrations, diagrams, tables, and charts (Fisher, 2009; Hall & Sabey, 2007, p. 262; Martinez & McGee, 2000, p. 166; Norman, 2012, p. 740). These text features are often critical to comprehending the material, but students must be given explicit instruction on their importance and how to interpret them effectively

(Norman, 2012, p. 739; Risko et al., 2011, p. 376). Students need to be aware that text features can help organize information in the text in a way that is quick and easy to absorb and that text features may provide additional information not found in writing (Norman, 2012, p. 740). Otherwise, students often misinterpret how to use these text features or skip over them altogether (McTigue & Flowers, 2011, as cited in Coleman, Bradley, & Donovan, 2012, p. 35; Hall & Sabey, 2007, p. 265). Similar to text features, there are a variety of text structures students may encounter while reading informational text, which is noticeably different than narrative text (Armbruster, 1984, as cited in Coiro & Dobler, 2007, p. 218; Duke, 2000, as cited in Coiro & Dobler, 2007, p. 218; Dymock & Nicholson, 2010, p. 166). Common informational text structures include cause and effect, compare and contrast, description, and sequence (Meyer, 1985, as cited in Hall & Sabey, 2007, p. 263; Fisher, 2009; Risko et al., 2011, p. 376), and sometimes a single text may contain more than one of these structures (Chambliss & Calfee, 1989, as cited in Hall & Sabey, 2007, p. 263). As students are taught these structures, they can better predict the format the text they are reading might take to aid in their understanding (Lapp et al., 2010, p. 426). Finally, nonfiction texts often contain challenging academic vocabulary students are unfamiliar with (Dymock & Nicholson, 2010, p. 166; Hall & Sabey, 2007, p. 262). Students may not be able to apply familiar strategies to learning content-area vocabulary because they often do not have personal experience or prior knowledge of the topics being discussed (Dymock & Nicholson, 2010, p. 166; Hall & Sabey, 2007, p. 262). Comprehension of text decreases as students encounter more unknown words; therefore, teachers must include vocabulary instruction as a part of their strategy for teaching informational text. According to Block and Duffy (2008), text features, text structures, and academic vocabulary found in informational text are more challenging to comprehend than narrative text (as cited in Cummins & Stallmeyer-Gerard, 2011, p. 394). Teachers must address text features, text structures, and vocabulary found in

informational text if students are to successfully comprehend what they are reading.

Many research-based strategies combine the previously mentioned components of successful comprehension and nonfiction instruction. One strategy that has been explored is the use of text mapping with expository text. A text map is a graphic framework that aids students in organizing information based on the text features present in the reading (Caverly et al., 1995, p. 191; Lapp et al., 2010, p. 423; Spencer, 2003, p. 752). The following three studies all used text mapping in different ways to aid in comprehension of informational text.

In Spencer's (2003) study with text maps, the teacher prepares the text map for students by identifying the features of the text and developing prompts for the students to respond to. Students use the text map to preview and record responses, and then revisit the text map to provide additional information after reading. Text maps used in this format can support activating students' prior knowledge, answering questions, responding to text, locating vocabulary, and identifying and interpreting text features. However, a weakness of text maps used in this format is its teacher-centered focus. Students do not have to predict the content or structure of the text because the organizer is already generated for them. Also, the text map is structured as a list of questions and not a visual representation. The students do not learn how the information could be visually organized and do not take part in creating a visual representation.

Caverly et al. (1995) developed a four-step, text-mapping strategy based on the acronym PLAN. In the Predict stage, students design a visual representation based on the text structure the information including important text features such as titles, headings, and bolded or highlighted words. As they move to the Locate stage, they identify information they know on their map with a checkmark and unknown information with a question mark. This step activates their prior knowledge related to the topics discussed in the text. The Add stage takes place during reading. As students encounter information in the text, they add

paraphrased statements to their maps. Students must answer the question marks they have on their maps and ask themselves if they learned new information about concepts they identified with a checkmark. The final stage is Note. The initial step of Note is to modify their text map if students incorrectly predicted the text structure. After a final map is drafted, students can use their maps to complete a variety of tasks. They could be asked to generate the map from memory, write a summary of the information, engage in discussion, or write in a learning log. This strategy was initially used with college students enrolled in a developmental reading course as a result of failing reading scores on state assessments. The strategy showed promise in assisting struggling readers with self-awareness, and was therefore adapted for students in middle school. Once again, PLAN showed positive results for low-level readers as well as students performing at grade level. While this strategy requires students to use many comprehension skills and addresses unique features of informational text, it does not call for students to include visual representations within their text maps. Since the CCSS specifically state students must be able to communicate information through visual displays, this seems like a missed opportunity of using text maps in this manner.

Perhaps taking note from this, Lapp et al. (2010) created a strategy called text mapping plus in which student-created graphics combine with written phrases to create a text map of the information. In text mapping plus, students use a standard graphic organizer as a starting point. As they read, they write or illustrate words, events, and ideas found in the text. The amount of text allowed in the map can be determined by the teacher. There are a number of weaknesses in this method to note. Since the graphic organizer is a generic map created by the teacher, it does not ask students to predict or be aware of the structure of the text. The stages of this method also do not specifically call upon students' prior knowledge of the topic before reading or draw attention to content vocabulary in the text. However, this is the only strategy of the three which requires student to include self-created graphics.

Related to the use of student-created graphics in the text mapping plus strategy, Coleman et al. (2012) studied the impact of explicit visual representation instruction on the ability of students to use communicate using self-created visuals. According to Coleman & Dantzler (2010), Martins (2002), and Walpole (1999), advances in technology and publishing have led to the inclusion of more complex visual information in expository text (Coleman et al., 2012, p. 31). Students are expected to read text rich with visual information and include them in their own informational compositions. The study revealed that after receiving explicit instruction on visual representations, second-grade students were able to write informational text that included visual representations illustrating written ideas, comparing ideas, and explaining processes.

After an examination of a variety of text-mapping strategies, it appears that the PLAN text-mapping strategy used by Caverly et al. (1995) demonstrates great potential in aiding the comprehension of informational text for diverse students. It supports the use of researched-based comprehension strategies, focuses on distinct features of informational text, and provides students with a step-by-step framework they can learn to implement independently. However, the question remains whether the lack of focus on visual displays in this strategy will impact students' ability to communicate beyond written text. Therefore, this study evaluates the impact of PLAN on the comprehension of informational text for students of varied reading levels and whether or not additional instruction beyond PLAN is necessary for students to successfully create their own visual representations.

CHAPTER 3

METHODOLOGY

Participants

The study was conducted at a suburban school located in the Midwest. The school reported an enrollment of 661 students in October 2012. During the 2011-2012 school year, the school's ethnic population was represented by the following percentages: 79.09% White, 10.13% Hispanic, 3.51% Black/African American, and 7.27% noted as unspecified ethnic students. A minority of the school's population (21.69%) were considered economically disadvantaged. The study included participants from two fourth-grade ELA general education classes (see Table 1).

TABLE 1

DESCRIPTIVE STATISTICS FOR PARTICIPANTS

Group	Number	Gender		Ethnicity/Race					Educational Services		
		Male	Female	Asian	Black/African American	Hispanic	Native Hawaiian/Other	White	IEP	GEI	504
PLAN	22	12	10	3	0	0	1	18	0	6	0
PLAN + Visuals	22	12	10	0	1	2	0	19	2	3	1

A total of 44 fourth-grade students were included in the study. Twenty-four of the students were male, and the other twenty students were female. Thirty-seven of the students were White, three were Asian, two were Hispanic, one was African American, and one was a Pacific Islander. Two students in the PLAN + visuals group had Individualized Education Programs (IEPs) and received special education services including classroom paraprofessional support. Nine total students had General Education Intervention (GEI) plans. GEI plans are based on emotional, behavioral, or academic needs displayed by students and are initiated by classroom teachers. These students qualified for additional

classroom support, but did not receive special education services. One student in the PLAN + visuals group had a 504 plan. This student had special health care needs that were accommodated through the 504 plan and did not receive special education services. All participants were nine or ten years old.

Tables 2 and 3 further describe participants based on their reading performances at the end of third grade and the beginning of fourth grade for each participating group. Students without a displayed score for either assessment did not attend the school district during the testing period.

TABLE 2

PLAN GROUP PARTICIPANT ASSESSMENT DATA

	3 rd Grade State Reading Assessment Scores (%)	NWEA Reading Goals Survey (RIT Score)		3 rd Grade State Reading Assessment Scores (%)	NWEA Reading Goals Survey (RIT Score)
Student			Student		
1	91	209	12	79	199
2	97	229	13	82	208
3	91	206	14	84	203
4	86	210	15	90	210
5	82	204	16	74	195
6	87	213	17	83	206
7	91	214	18	88	199
8	86	210	19	97	210
9	66	193	20	81	194
10		197	21	76	185
11	84	205	22	91	218
Group Average	85	205			

3 rd Grade State Reading Assessment Scores	Academic Warning (0-56%)	Approaches Standard (57-67%)	Meets Standard (68-80%)	Exceeds Standard (81-88%)	Exemplary (89-100%)
NWEA Reading Goals Survey	Below Benchmark (<199.8 RIT)	Above Benchmark (>199.8 RIT)			

TABLE 3

PLAN + VISUALS GROUP PARTICIPANT ASSESSMENT DATA

	3 rd Grade State Reading Assessment Scores (%)	NWEA Reading Goals Survey (RIT Score)		3 rd Grade State Reading Assessment Scores (%)	NWEA Reading Goals Survey (RIT Score)
Student			Student		
1	78	202	12	90	206
2	86	210	13	86	195
3	86	214	14		209
4	76	201	15	78	197
5	75	209	16	90	210
6	78	194	17	100	214
7	87	199	18	94	209
8	88	195	19	84	198
9	92	207	20	88	218
10	91	214	21		
11	89	214	22	89	215
Group Average	86	206			

3 rd Grade State Reading Assessment Scores	Academic Warning (0-56%)	Approaches Standard (57-67%)	Meets Standard (68-80%)	Exceeds Standard (81-88%)	Exemplary (89-100%)
NWEA Reading Goals Survey	Below Benchmark (<199.8 RIT)	Above Benchmark (>199.8 RIT)			

Assessment data show the groups are comparable based on State Reading Assessment and Northwest Evaluation Association (NWEA) Reading Goals Survey scores. On the State Reading Assessment, students are placed into five categories based on the percent correct achieved on the test: Academic Warning (0-56%), Approaches Standard (57-67%), Meets Standard (68-80%), Exceeds Standard (81-88%), and Exemplary (89-100%). In the PLAN group, there were no students on Academic Warning, one student Approaching Standard student, three students who Met Standard, ten students who Exceeded Standard, and seven

Exemplary students. In the PLAN + visuals group, there were no students on Academic Warning or Approaching Standard, five students who Met Standard, seven students who Exceeded Standard, and eight Exemplary students.

On the NWEA Reading Goals Survey, a Rasch Unit (RIT) score of 199.8 was the 2011 reported status norm for fourth grade at the beginning of the year. According to this benchmark, the PLAN group had seven students scoring below and fifteen students scoring above the fourth-grade benchmark. In the PLAN + visuals group, there were six students scoring below and fifteen students scoring above the fourth-grade benchmark. Overall, the PLAN + visuals group averaged one percent higher on the State Reading Assessment and one RIT point higher on the NWEA Reading Goals Survey. The two groups were an appropriate match for this study based on similarities in group size, gender, ethnicity/race, educational services, and reading performance.

Procedures

All students were assessed on their ability to comprehend and visually represent expository text prior to and after receiving instruction on using the PLAN text-mapping strategy. The study took place over five phases of instruction (see Appendix A). Each phase of instruction is described in further detail.

Phase One

In the state where this study took place, the understanding and use of nonfiction text features was a tested standard prior to the adoption of the CCSS. Therefore, all students were given instruction on the identification of text features demonstrating the basic, required foundation for expository reading comprehension. Text feature instruction took place over a five-day period. On the first day of instruction, students viewed a Promethean flipchart that introduced common text features (see Appendix B). After viewing the flipchart, students worked with partners to complete a worksheet asking them to locate and identify text features

found in their reading textbooks on the second day (see Appendix C). On the third day of instruction, students used their science textbooks to use, locate, and identify text features found in that resource (see Appendix D). Students used an edition of *Scholastic News* as their resource for text feature practice on the fourth day of instruction (see Appendix E). On the final day of instruction, the group participated in a Kagan Quiz, Quiz, Trade activity (see Appendix F) to review text features before taking a quiz on a Promethean flipchart (see Appendix G).

Phase Two

After initial text feature instruction took place, both groups then took a pretest (see Appendix H) over an expository lesson (see Appendix I) in a science unit titled *Movements in the Solar System* from Scott Foresman's (2000) textbook *Science*. The pretest was conducted to identify any prior knowledge students may have had on the given topic. On the following day, students read the lesson and took a posttest containing questions identical to the pretest with the addition of a visual representation prompt (see Appendix J). The topic of the prompt was not visually represented within the lesson, so students would not have the option of duplicating an image already presented to them. Students used partitions for both the pretest and posttest to help ensure their responses were kept private. This testing served as a measurement of their comprehension and visual representation abilities prior to receiving instruction in the text-mapping strategy.

Phase Three

During the next phase of instruction, three sample informational passages (see Appendix K) were used to introduce students to common expository text structures (cause and effect, compare and contrast, and description). Each structure and passage was discussed and read as a group. Students were also shown a model graphic organizer (see Appendix L) suitable for each text structure.

Phase Four

After students were exposed to the different expository text structures, both groups received the second lesson from their science textbook (see Appendix M). Students were given a handout (see Appendix N) and introduced to the PLAN text-mapping strategy. Each step of PLAN was modeled and discussed as a group. For the final stage, Note, the group composed a reflection based on what they had learned. In addition to learning PLAN, students in the PLAN + visuals group were given direct instruction on the visual representations used in each sample text. Students were asked to locate, identify, and interpret the visual representations found in the passages while reading. During the Add phase of PLAN, the PLAN + visuals group was also invited to use words, include visuals, and self-create graphics to record important information.

After receiving whole-group instruction on PLAN, students were asked to practice using PLAN with a partner on the third expository science lesson (see Appendix O). Once again, the PLAN + visuals group was invited to include both words and visuals in their text maps. Assistance was given as needed and all students were provided feedback after completing their text maps.

Following work in pairs, students were asked to individually use PLAN on the fourth science lesson (see Appendix P). Only the PLAN + visuals group was told that visuals could be incorporated into their maps. Assistance was given as needed and all students were provided feedback after completing their text maps.

Phase Five

The final phase of the study began with a pretest (see Appendix Q) in both groups over the final lesson in their science unit (see Appendix R). Once again, this was to identify any prior knowledge students possessed on the given topic. After the pretest, the PLAN group used PLAN without visuals to map the lesson, and the PLAN + visuals group used

PLAN with visuals to map the lesson. The students took a posttest after the completion of their text maps containing questions identical to the pretest with the addition of a visual representation prompt (see Appendix S). The topic of the prompt was not visually represented within the lesson, so students would not have the option of duplicating an image already presented to them. Students used partitions for both the pretest and posttest to help ensure their responses were kept private.

Assessments

Students' nonfiction comprehension and visual representation abilities were examined in two ways. Students took a pretest and posttest after receiving instruction on text features and after receiving instruction on the PLAN text-mapping strategy. The pretests and posttests both contained eight free-response test questions to assess students' comprehension of the topic before and after reading the expository lessons. In addition, the posttests also included a second section requiring students to create a visual representation of a concept discussed in the lesson. These visuals were analyzed based on their type, sophistication, and ability to accurately communicate concepts from the chapter.

Analysis of Data

Data collected from the pretests and posttests given were evaluated in a number of ways. The free-response questions were scored based on a rubric for lesson one (see Appendix T) and lesson five (see Appendix U). Gain scores and means for the free-response questions were then calculated between the pretest and posttest following text-feature instruction and following instruction on PLAN. Gain scores and whole-group mean gains were compared between these phases of instruction for each group as a whole to show the impact of text mapping on students' comprehension overall. Mean gain scores were also compared between the two groups to assess whether additional visual representation instruction in the PLAN + visuals group influenced student comprehension. Finally, mean

gain scores were compared between students identified as performing below grade level and at or above grade level on school assessments within each group. The rationale for this comparison was to see if prior low assessment performance would impact the effectiveness of the PLAN strategy.

Students' visual representations were also evaluated based on type, sophistication, and accuracy of the information present in the visual. Visuals were categorized by type guided by Moline's (2012) system. His work also aided in determining the sophistication of the images based upon elements of graphic design and text features present in the students' representations. These elements (caption, label, heading, rule, box, arrow) were chosen when analyzing student visuals because they were discussed during classroom instruction and/or present in images throughout their textbook lessons. Accuracy of their representations was determined by the presence of key concepts discussed in the lessons. For example, the first prompt asked students to show the effect of Earth's rotation. Therefore, student visuals should have included the Earth, sun, rotation, day, and night. The final prompt asked students to show the difference between meteors and meteorites. Student visuals should have included a meteor, meteorite, Earth, the meteor burning, and the meteorite impacting Earth's surface. The sophistication and accuracy of images following PLAN instruction were compared with images before PLAN instruction within each group to examine the impact of text mapping on their ability to visually convey information. The sophistication and accuracy of visuals between the PLAN group and the PLAN + visuals group were also examined to determine if explicit instruction on visual representations influenced the quality of the images students created. Finally, the sophistication and accuracy of images were compared between students identified as performing below grade level and at or above grade level on school assessments within each group. This comparison helped determine if low reading performance affected students' ability to produce visual representations.

CHAPTER 4

RESULTS

Free-Response Questions

Students' expository comprehension was assessed before and after instruction in the PLAN text-mapping strategy. Students took a pretest prior to reading nonfiction lessons to identify prior knowledge on the topic, read the expository lesson, and then took a posttest to demonstrate the information gained from the reading. During the first phase of assessment, students read the lesson without the use of any instructed strategy and took a posttest following completion of the reading. During the final phase of assessment, students read the lesson creating a PLAN text map of the information and took a posttest following the completion of their maps. Pretests and posttest for each phase of assessments contained eight identical free-response questions.

Pretest and posttest free-response questions were evaluated for lesson one and lesson five. Pretest and posttest percentages were determined, allowing individual gain scores and group means to be calculated for the PLAN group (Table 4) and the PLAN + visuals group (Table 5).

TABLE 4

PLAN GROUP FREE RESPONSE ASSESSMENT DATA

PLAN Group	Lesson 1			Lesson 5		
	Student	Pretest %	Posttest %	Gain Score	Pretest %	Posttest %
1	30.00	25.00	-0.07	20.83	41.67	0.26
2	20.00	40.00	0.25	20.83	54.17	0.42
3	15.00	25.00	0.12	16.67	16.67	0.00
4	30.00	40.00	0.14	25.00	33.33	0.11
5	15.00	15.00	0.00	20.83	16.67	-0.05
6	0.00	30.00	0.30	25.00	50.00	0.33
7	20.00	30.00	0.13	25.00	50.00	0.33
8	10.00	25.00	0.17	12.50	25.00	0.14
9	5.00	10.00	0.05	8.33	16.67	0.09
10	0.00	35.00	0.35	12.50	37.50	0.29
11	10.00	35.00	0.28	12.50	50.00	0.43
12	5.00	15.00	0.11	25.00	41.67	0.22
13	20.00	20.00	0.00	8.33	37.50	0.32
14	25.00	40.00	0.20	37.50	33.33	-0.07
15	25.00	40.00	0.20	20.83	37.50	0.21
16	10.00	15.00	0.06	12.50	16.67	0.05
17	10.00	20.00	0.11	16.67	25.00	0.10
18	20.00	25.00	0.06	4.17	50.00	0.48
19	20.00	40.00	0.25	20.83	50.00	0.37
20	30.00	20.00	-0.14	29.17	45.83	0.24
21	15.00	25.00	0.12	16.67	25.00	0.10
22	20.00	25.00	0.06	4.17	45.83	0.43
Group Mean	16.14	27.05	0.12	17.99	36.36	0.22

TABLE 5

PLAN + VISUALS GROUP FREE-RESPONSE ASSESSMENT DATA

PLAN + Visuals Group	Lesson 1			Lesson 5		
	Student	Pretest %	Posttest %	Gain Score	Pretest %	Posttest %
1	5.00	5.00	0.00	0.00	37.50	0.38
2	5.00	20.00	0.16	8.33	37.50	0.32
3	15.00	35.00	0.24	25.00	54.17	0.39
4	15.00	25.00	0.12	4.17	37.50	0.35
5	0.00	25.00	0.25	12.50	29.17	0.19
6	5.00	5.00	0.00	0.00	8.33	0.08
7	15.00	35.00	0.24	12.50	16.67	0.05
8	20.00	30.00	0.13	0.00	20.83	0.21
9	10.00	20.00	0.11	4.17	45.83	0.43
10	15.00	35.00	0.24	20.83	29.17	0.11
11	5.00	25.00	0.21	33.33	54.17	0.31
12	10.00	20.00	0.11	8.33	29.17	0.23
13	10.00	50.00	0.44	12.50	25.00	0.14
14	10.00	20.00	0.11	12.50	20.83	0.10
15	20.00	15.00	-0.06	8.33	20.83	0.14
16	10.00	30.00	0.22	4.17	37.50	0.35
17	25.00	45.00	0.27	8.33	54.17	0.50
18	10.00	20.00	0.11	33.33	37.50	0.06
19	10.00	20.00	0.11	16.67	20.83	0.05
20	5.00	35.00	0.32	20.83	41.67	0.26
21	10.00	15.00	0.06	12.50	33.33	0.24
22	15.00	40.00	0.29	12.50	41.67	0.33
Group Mean	11.14	25.91	0.17	12.31	33.33	0.24

Using gain score data for the PLAN group, student performance was compared between lesson one and lesson five to evaluate the impact of text mapping on students' comprehension on an individual basis. Figure 1 shows the results for these two phases of instruction.

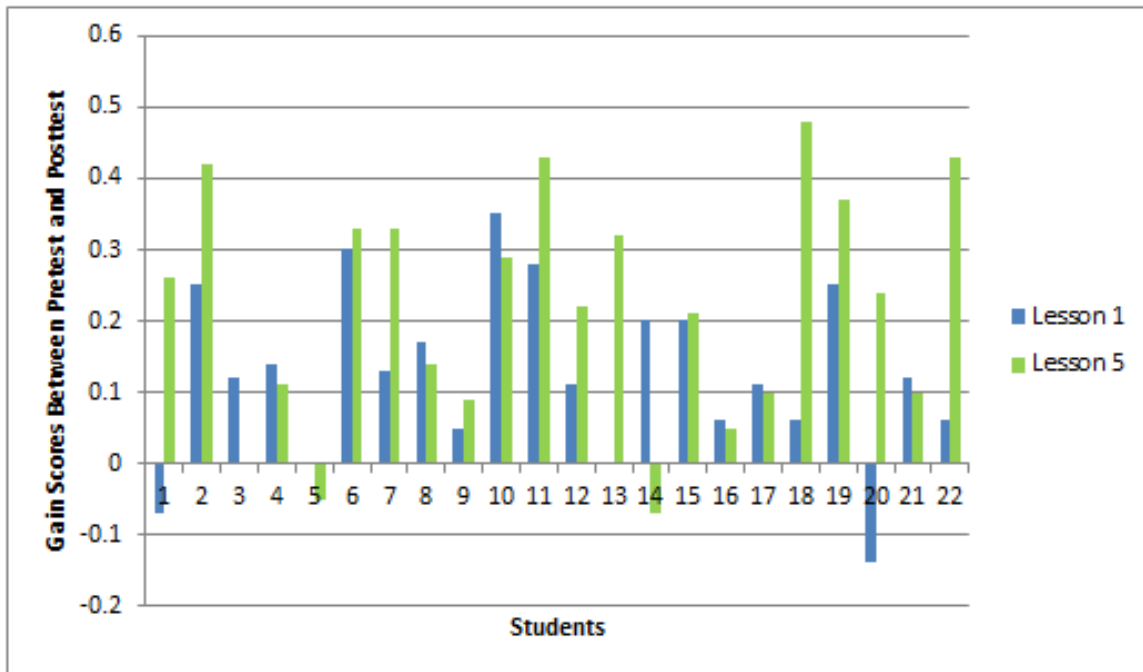


Figure 1. PLAN group gain scores on fourth-grade expository lesson tests.

Lesson one gain scores ranged from -0.14 to 0.35. Students A1 and A20 had negative gain scores, and students A5 and A13 made a gain of zero. Four students showed gain scores within the 0.01 to 0.10 range, nine students showed gain scores within the 0.11 to 0.20 range, four students showed gain scores within the 0.21 to 0.30 range, and one student showed a gain score within the 0.31 to 0.40 range. Lesson five gain scores ranged from -0.07 to 0.48. Students A5 and A14 had negative gain scores, and student A3 made a gain of zero. Four students showed gain scores within the 0.01 to 0.10 range, two students showed gain scores within the 0.11 to 0.20 range, five students showed gain scores within the 0.21 to 0.30 range, four students showed gain scores within the 0.31 to 0.40 range, and four students showed gain scores within the 0.41 to 0.50 range. Comparing the gain scores from lesson one when students read without an instructed strategy to lesson five when students read using the PLAN text-mapping strategy, nine students' gain scores decreased, and thirteen students'

gain scores increased. To determine if the PLAN group made statistically significant gains from the lesson one posttest to the lesson five posttest, a one sample t test was computed. Results indicated that the gains this group made were statistically significant $t(21) = 5.887$ $p < .001$.

The PLAN group performance was also analyzed by comparing the mean gain scores for the group between the lesson one and lesson five assessments to evaluate the impact of text mapping on comprehension for the group as a whole. Figure 2 shows the results for these two phases of instruction.



Figure 2. PLAN group mean gain scores on fourth-grade expository lesson tests.

The lesson one mean gain score for the PLAN group was 0.12. The lesson five mean gain score for the PLAN group was 0.22, an increase of 0.10 in the whole-group mean gain score.

Assessment data was analyzed in the same manner for the PLAN + visuals group. Using gain score data for the PLAN + visuals group, student performance was compared between lesson one and lesson five to evaluate the impact of text mapping on students'

comprehension on an individual basis. Figure 3 shows the results for these two phases of instruction.

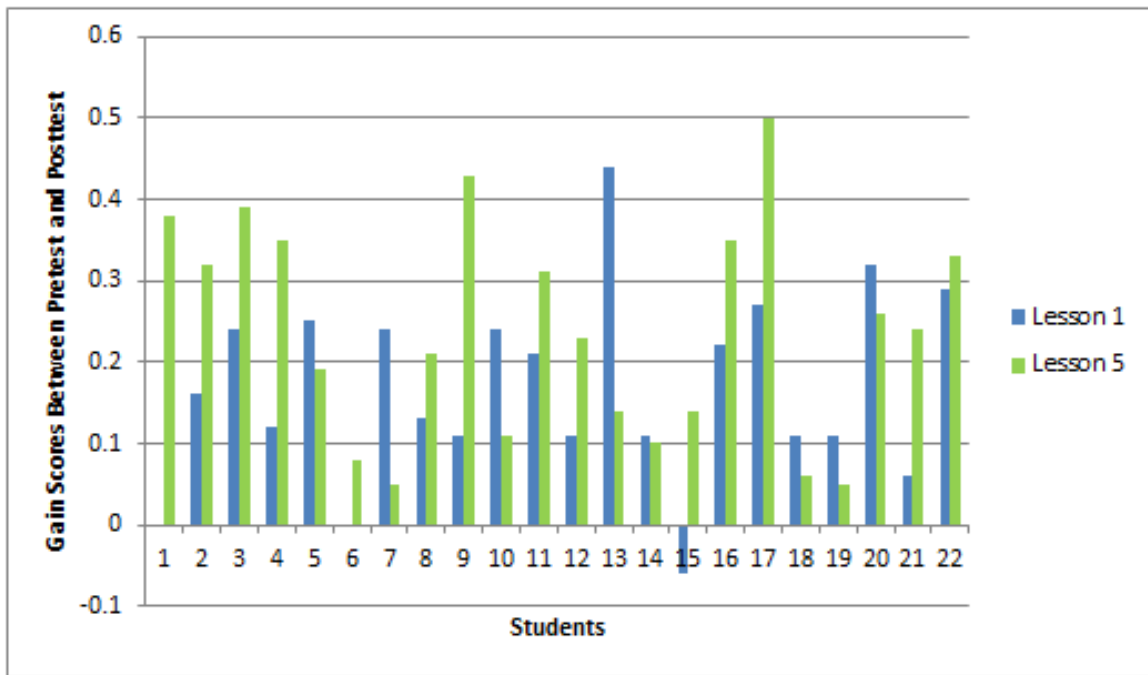


Figure 3. PLAN + visuals group gain scores on fourth-grade expository lesson tests.

Lesson one gain scores ranged from -0.06 to 0.44. Student B15 had a negative gain score, and students B1 and B6 made a gain of zero. One student showed a gain score within the 0.01 to 0.10 range, eight students showed gain scores within the 0.11 to 0.20 range, eight students showed gain scores within the 0.21 to 0.30 range, one student showed a gain score within the 0.31 to 0.40 range, and one student showed a gain score within the 0.41 to 0.50 range. Lesson five gain scores ranged from 0.05 to 0.50. Five students showed gain scores within the 0.01 to 0.10 range, four students showed gain scores within the 0.11 to 0.20 range, four students showed gain scores within the 0.21 to 0.30 range, seven students showed gain scores within the 0.31 to 0.40 range, and two students showed gain scores within the 0.41 to 0.50 range. Comparing the gain scores from lesson one when students read without an instructed strategy

to lesson five when students read using the PLAN text-mapping strategy, eight students' gain scores decreased, and fourteen students' gain scores increased. To determine if the PLAN + visuals group made statistically significant gains from the lesson one posttest to the lesson five posttest, a one sample t test was computed. Results indicated that the gains this group made were statistically significant t

(21) = 4.148, $p < .001$.

The PLAN + visuals group performance was also analyzed by comparing the mean gain scores for the group between the lesson one and lesson five assessments to evaluate the impact of text mapping on comprehension for the group as a whole. Figure 4 shows the results for these two phases of instruction.



Figure 4. PLAN + visuals group mean gain scores on fourth-grade expository lesson tests.

The lesson one mean gain score for the PLAN + visuals group was 0.17. The lesson five mean gain score for the PLAN + visuals group was 0.24, an increase of 0.07 in the whole-group mean gain score.

Mean gain scores were not only assessed within groups, but between the PLAN group and the PLAN + visuals group. The purpose of this was to examine whether additional visual representation instruction in the PLAN + visuals group affected student comprehension. Figure 5 shows the comparison of these two groups.

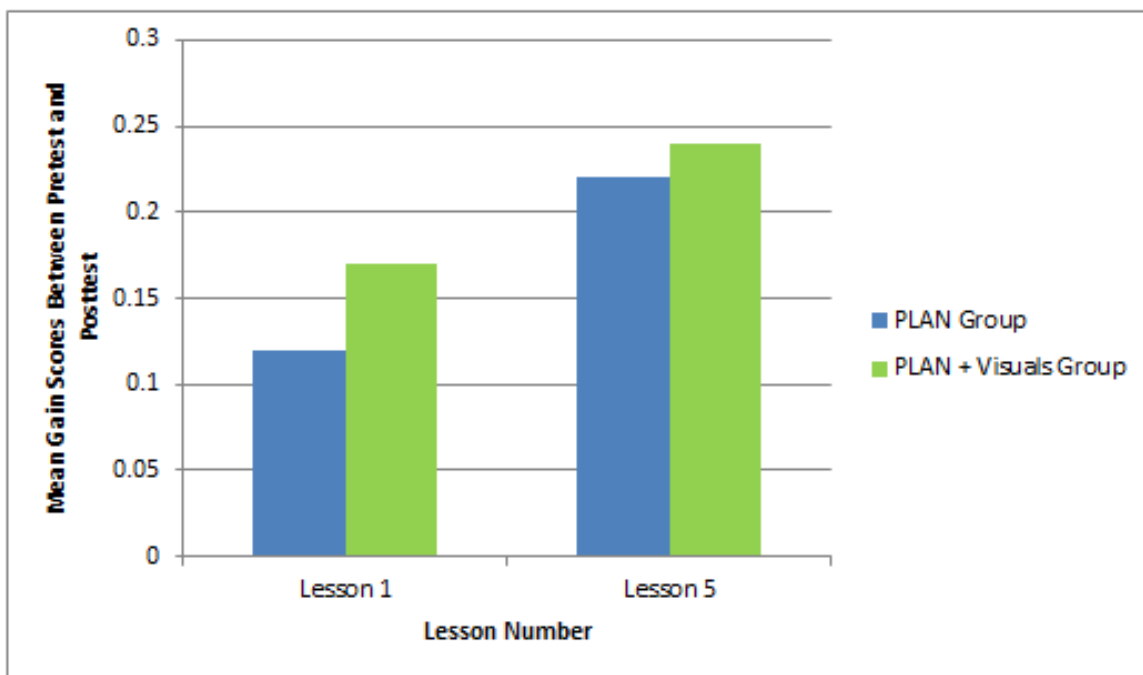


Figure 5. Mean gain scores comparison on fourth-grade expository lesson tests.

Lesson one shows the gain scores of each group prior to instruction in the PLAN text-mapping strategy. The PLAN group showed a gain score of 0.12, and the PLAN + visuals group showed a gain score of 0.17, a difference of 0.05 between the two groups. Lesson five shows the gain scores of each group after instruction in and the use of the PLAN text-mapping strategy. The PLAN group showed a gain score of 0.22, and the PLAN + visuals

group showed a gain score of 0.24, a difference of 0.02 between the two groups. Comparing lesson one scores with lesson five scores, the PLAN group increased their gain score by 0.10, and the PLAN + visuals group increased their gain score by 0.07. To examine if the gains made by either group outperformed the other, a one way analysis of variance was computed. Results indicate that the gains made by the PLAN group ($M=3.32$, $SD= 2.64$) were not statistically significantly different from the gains made by the PLAN + visuals group ($M=2.818$, $SD = 3.19$).

Last, data were compared within each group between students who were and were not identified as performing below grade level on prior school reading assessments. This was done to evaluate whether PLAN was as effective for low performers as those performing at or above grade level in reading. Figure 6 shows the results of this comparison for the PLAN group.

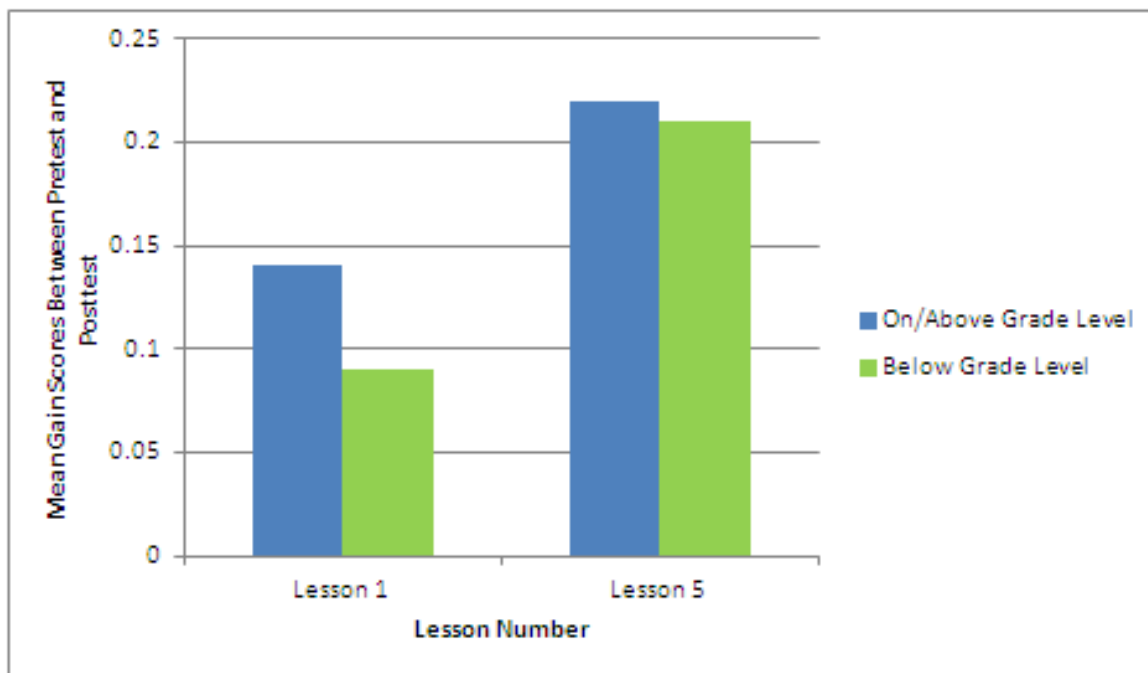


Figure 6. PLAN group mean gain scores comparison on fourth-grade expository lesson tests.

Lesson one shows the mean gain score of each group prior to instruction in the PLAN text-mapping strategy. Students on or above grade level showed a gain score of 0.14, and students below grade level showed a gain score of 0.09, a difference of 0.05 between the two groups. Lesson five shows the mean gain score of each group after instruction in and the use of the PLAN text-mapping strategy. Students on or above grade level showed a gain score of 0.22, and students below grade level showed a gain score of 0.21, a difference of 0.01 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level students increased their gain score by 0.08. Below-grade-level students increased their gain score by 0.12 from the first lesson to the fifth lesson.

Figure 7 shows the results of the comparison between on- or above-grade-level students and below-grade-level students for the PLAN + visuals group.

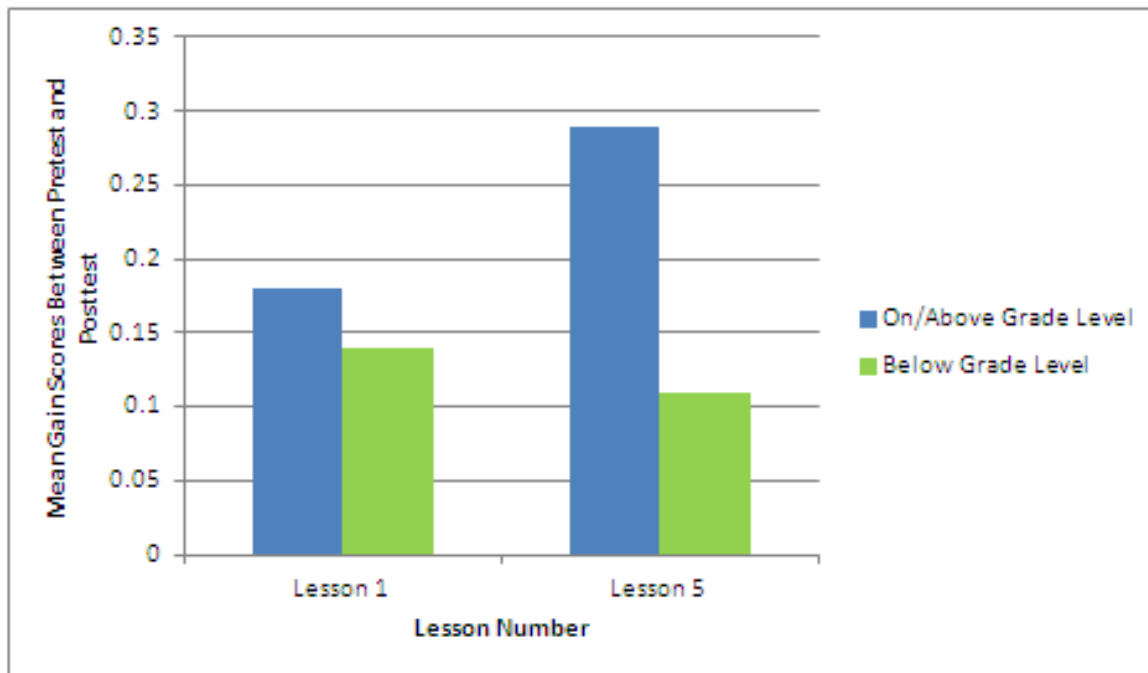


Figure 7. PLAN + visuals group mean gain scores comparison on fourth-grade expository lesson tests.

For lesson one, students on or above grade level showed a gain score of 0.18, and students below grade level showed a gain score of 0.14, a difference of 0.04 between the two groups. On lesson five, students on or above grade level showed a gain score of 0.29, and students below grade level showed a gain score of 0.11, a difference of 0.18 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level students increased their gain score by 0.11. Below-grade-level students' gain score decreased by 0.03 from the first lesson to the fifth lesson.

Visual Representations

In addition to evaluating students' expository comprehension, the ability to visually represent information was also assessed before and after instruction in the PLAN text-mapping strategy. Students were asked on both posttests to visually represent a topic discussed within the expository lesson. During the first phase of assessment, students read the lesson without the use of any instructed strategy and created their images following completion of the reading. During the final phase of assessment, students read the lesson creating a PLAN text map of the information and created their images following the completion of their maps. Visual representations were evaluated in three ways: type, sophistication, and accuracy of the information present in the visual.

In his book on visual literacy, Moline (2012) groups visual texts often encountered by students in the classroom based upon similarities in structure and purpose. The broad categories discussed include simple diagrams, analytic diagrams, process diagrams, structure diagrams, and graphs. Within each of these categories are a variety of visual representations that relate to a central theme of the group. Most visual representations produced by the students fell into the categories of simple diagrams, process diagrams, and graphs.

The central theme of simple diagrams is that they show the exterior of the subject matter. One type of simple diagram is a picture glossary. Picture glossaries can be used for a

variety of reasons, including summarizing gleaned information. Moline (2012) characterizes a picture glossary as “a diagram with labels. The labels name parts of the picture, while the picture helps define the labels” (p. 51). In order to aid in the categorization of visual representations in this study, criteria for the labels were created. Labels were required to point to the object with an arrow or line, be written on the object itself, or be written immediately next to the object and clearly demonstrate what it was attempting to name. The labels also had to name the composition of the object, part of the object, or the object as a whole. Figure 8 is an example of a picture glossary produced on the lesson 1 posttest in this study.

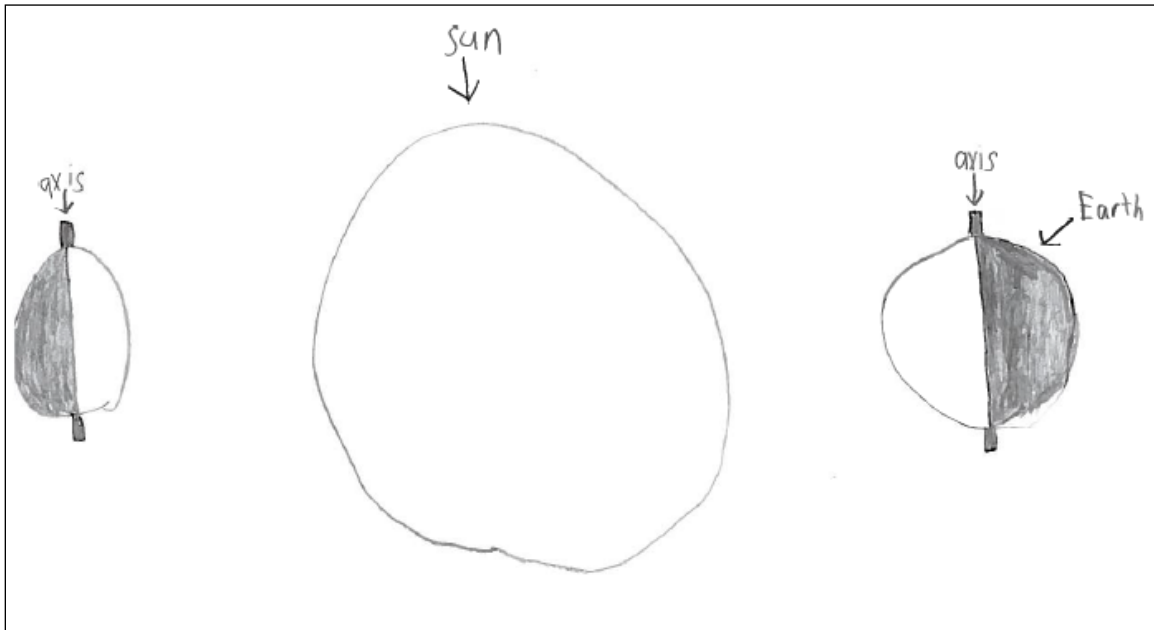


Figure 8. Picture glossary example.

Another type of simple diagram is a map. According to Moline (2012), “Maps are about places, distance, and location” (p. 70). One type of map discussed is a time map. “Time maps summarize a process that moves through time as well as space,” says Moline (2012, p. 89). This can be done in one of two ways: by use of arrows or symbols showing movement or

showing the same object or place at different times. Figure 9 shows a student's time map produced during the lesson 1 posttest.

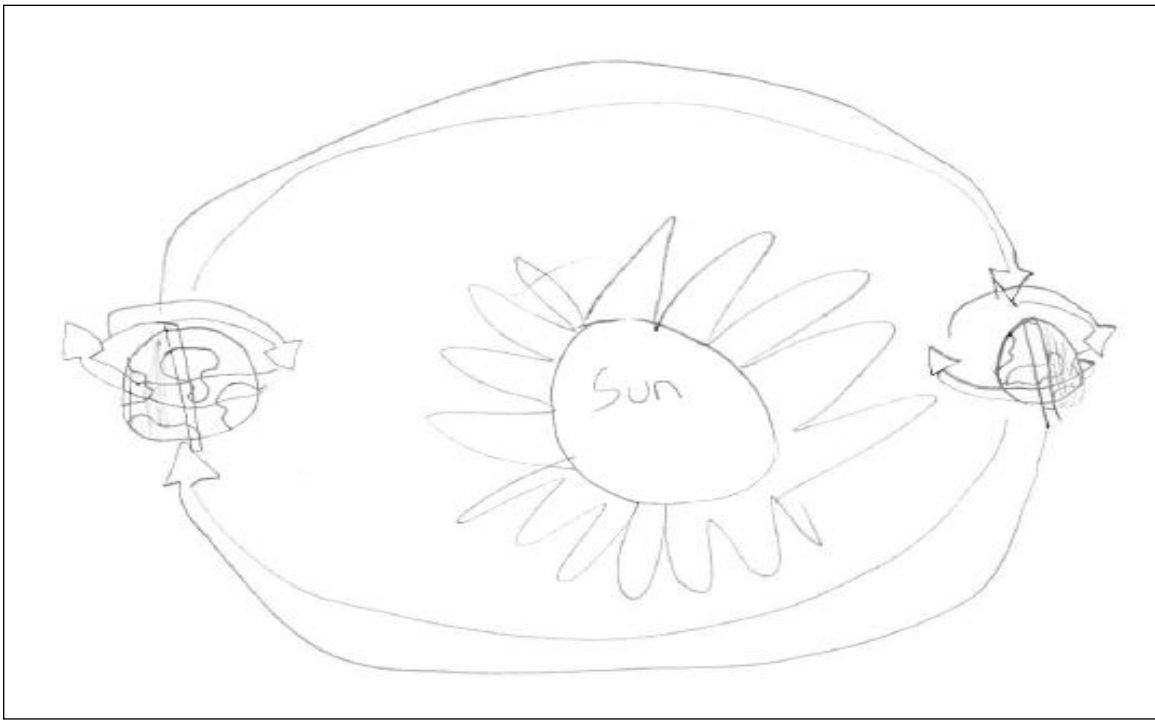


Figure 9. Time map example.

Process diagrams are grouped based on the purpose of communicating sequence. One type of process diagram is a flowchart. Moline (2012) states that flowcharts link “its subjects with lines or arrows to show a process that moves through time...or space” (p. 138). The simplest flowchart links images together using arrows in a single line (Moline, 2012, p. 140). Figure 10 is a flowchart created by a student during the lesson 5 posttest.

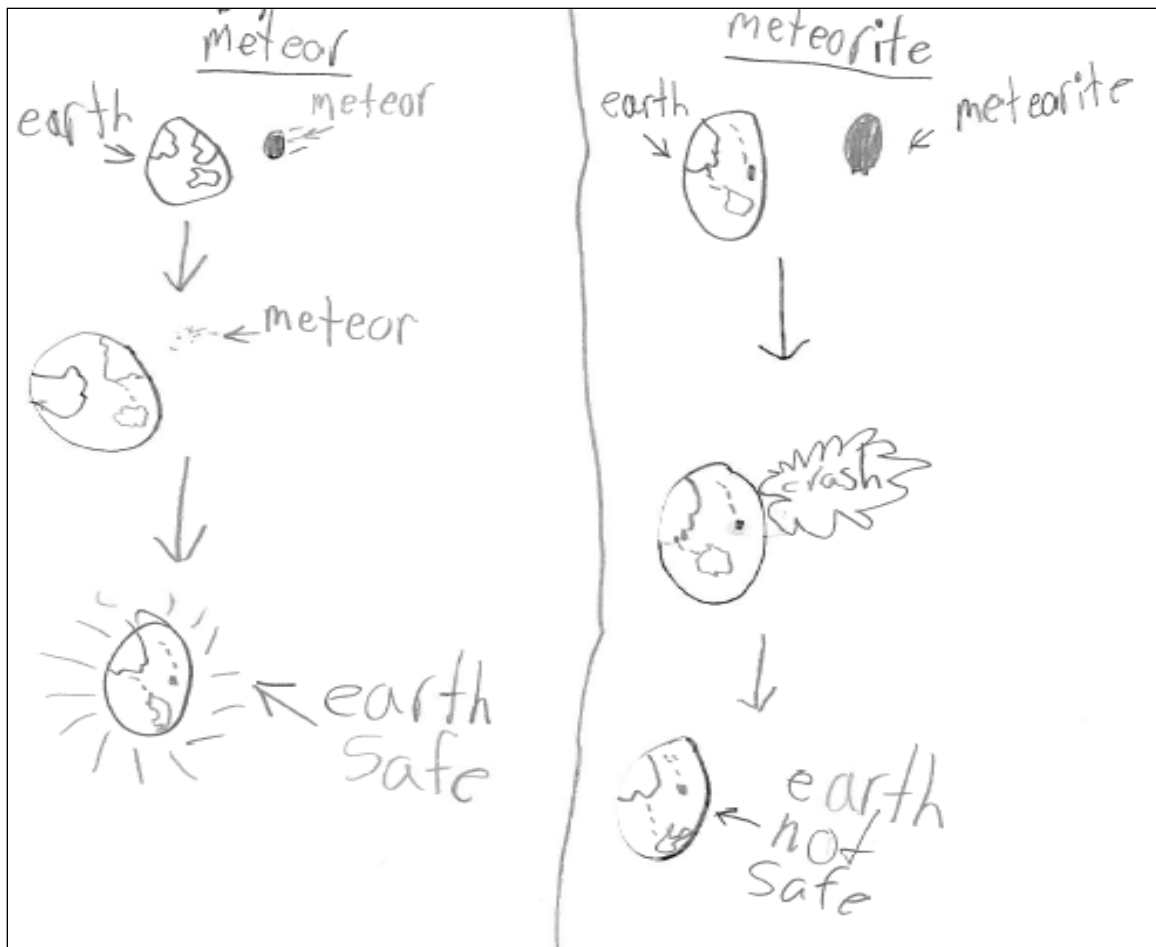


Figure 10. Flowchart example.

The central theme of graphs is that they measure information in order to rank or make comparisons. One common type of graph is a column graph. A column graph is almost identical to a bar graph except that it “measures information in units up or down the page” (Moline, 2012, p. 185). Figure 11 is an example of a column graph created by a student on the lesson 1 posttest.

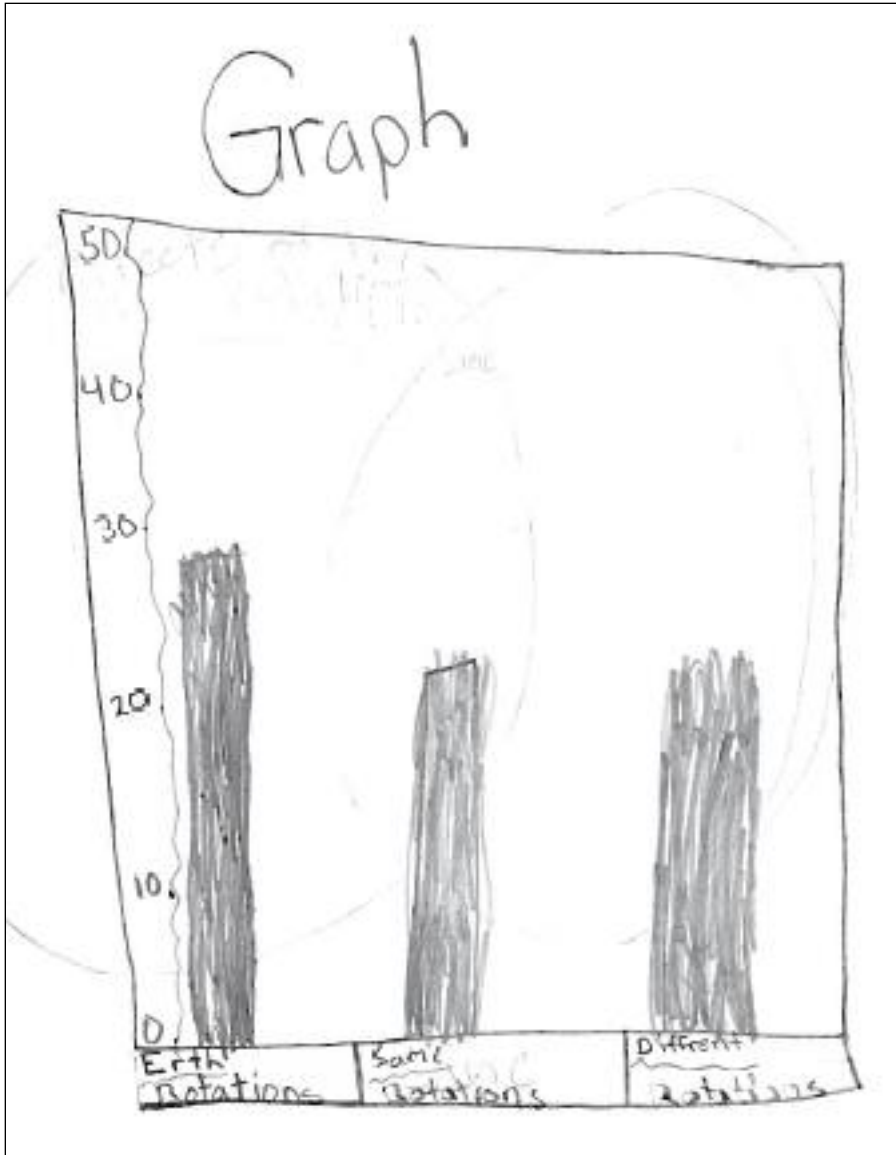


Figure 11. Column graph example.

One additional type of visual representation needed to be defined beyond Moline's (2012) categorizations for the purpose of this study. Multiple visual representations produced were more basic than the picture glossary. They were pictures that lacked labels identifying object composition, parts, or names. These visuals were therefore simply named illustrations. Figure 12 provides an example of an illustration completed during the lesson 1 posttest.



Figure 12. Illustration example.

After all representation types present in the students' visuals had been identified based on the preceding definitions, the number of images for each type from both the lesson 1 and lesson 5 posttests were recorded. Table 6 shows the breakdown for the PLAN group on both posttests, and Table 7 shows the breakdown for the PLAN + visuals group on both posttests.

TABLE 6

PLAN GROUP VISUAL REPRESENTATION TYPES

PLAN Group	Visual Type Lesson 1			Visual Type Lesson 5			
	Student	Illustration	Picture Glossary	Time Map	No Visual	Illustration	Picture Glossary
1			X			X	
2			X		X		
3			X			X	
4			X				XX
5		X				X	
6			X			XX	
7			X				X
8			X			XX	
9			X		X		X
10			X		X	X	
11			X		X		
12			X		X		X
13			X			XX	
14	X						XX
15			X			XX	
16			X		XX		
17	X					X	
18			X			X	
19			X			X	
20		X		X	X		
21			X			X	
22	X					XX	
Total	3	2	17	1	8	18	7

TABLE 7

PLAN + VISUALS GROUP VISUAL REPRESENTATION TYPES

PLAN + Visuals Group	Visual Type Lesson 1				Visual Type Lesson 5			
	Student	Illustration	Picture Glossary	Time Map	Column Graph	Illustration	Picture Glossary	Time Map
1	X						X	
2			X				XX	
3			X			XX		
4			X				XX	
5			X				X	X
6		X					X	
7			X				X	
8			X					X
9	X						XX	
10		X				XX		
11	X						X	X
12			X				XX	
13	X						X	
14			X			X		
15				X			XX	
16			X			XX		
17			X			XX		
18			X				X	
19			X				X	
20			X				X	
21		X				XX		
22			X					XX
Total	4	3	14	1	11	19	3	2

Most students in both groups chose to create similar types of visual representations in each of the lessons. In the first lesson, three students from the PLAN group and four students from the PLAN + visuals group chose to make an illustration, two students from the PLAN group and three students from the PLAN + visuals group chose to create a picture glossary, and seventeen students from the PLAN group and fourteen students from the PLAN + visuals group made a time map. The time map was by far the most popular choice in both groups. The one outlying visual type in lesson one was a column graph, made by a student in the PLAN + visuals group.

For lesson five, a majority of the students in each group chose to create two separate representations instead of combining images into one visual through the use of a dividing line or boxing items separately from one another. Therefore, those representations were coded two times, analyzing each image type separate from the other. Students with only one mark for lesson five created one visual representation. In the fifth lesson, the PLAN group created eight illustrations, and the PLAN + visuals group created eleven illustrations. The illustrations from the PLAN group were made by seven total students, and the PLAN + visuals group illustrations were created by six total students. The most popular choice in both groups was a picture glossary. The PLAN group was responsible for eighteen picture glossaries created by thirteen students, and the PLAN + visuals group had nineteen picture glossaries produced by fourteen students. Time maps were created seven times by five students in the PLAN group and three times by three students in the PLAN + visuals group. There were two outlying visual types in lesson five. One student from the PLAN group divided the paper into two separate sections, but used words, not a visual, in the second half to respond to the prompt. Another student from the PLAN + visuals group chose to divide the paper into two separate sections and created two flowcharts, one in each half. Overall, in the PLAN group, twelve students created two separate representations and ten created one. Of the twelve who created two images, eight created the same image in both divided parts of their pictures. In the PLAN + visuals group, thirteen students created two separate representations and nine created one. Of the thirteen who created two images, eleven created the same image in both divided parts of their pictures.

In addition to analyzing representations by type, visuals were also assessed based on their sophistication. While the type of image itself speaks to its complexity, the inclusion of text features and elements of graphic design can further engage readers in locating and understanding the concepts being communicated in visual representations. Students' visuals

were examined based on text features and design elements discussed during lessons in this study and/or present in the visual representations from the nonfiction lessons they read (see Appendix V). Without being exposed to these concepts previously, it would have been unreasonable to expect students to produce them in their own images. Table 8 shows the elements present or absent from visuals in the PLAN group.

TABLE 8
PLAN GROUP VISUAL REPRESENTATION ELEMENTS

PLAN Group	Visual Elements Lesson 1							Visual Elements Lesson 5							
	Student	Caption	Label	Heading	Rule	Box	Arrow/Line	Total	Caption	Label	Heading	Rule	Box	Arrow/Line	Total
1			X				X	2	X	X				X	3
2	X							1	X					X	2
3			X					1		X					1
4								0	X	X		X		X	4
5	X	X					X	3		X					1
6	X	X					X	3		X		X		X	3
7	X	X					X	3		X				X	2
8	X	X						2	X	X		X		X	4
9								0			X	X			2
10			X				X	2		X	X	X		X	4
11	X							1	X						1
12								0		X	X	X		X	4
13			X					1	X	X		X		X	4
14	X							1			X				1
15	X	X				X		3	X	X	X		X		4
16								0	X		X	X			3
17	X						X	2		X				X	2
18								0	X	X				X	3
19								0		X					1
20			X				X	2	X		X		X		3
21								0		X				X	2
22								0		X	X	X		X	4
Total	9	10	0	0	1	7	27	27	10	16	8	9	2	13	58

Using the data on from Table 8, student performance was compared in the PLAN group between lesson one and lesson five to evaluate the impact of text mapping on students' ability to communicate sophisticated visuals on an individual basis. Figure 13 shows the results for these two phases of instruction.

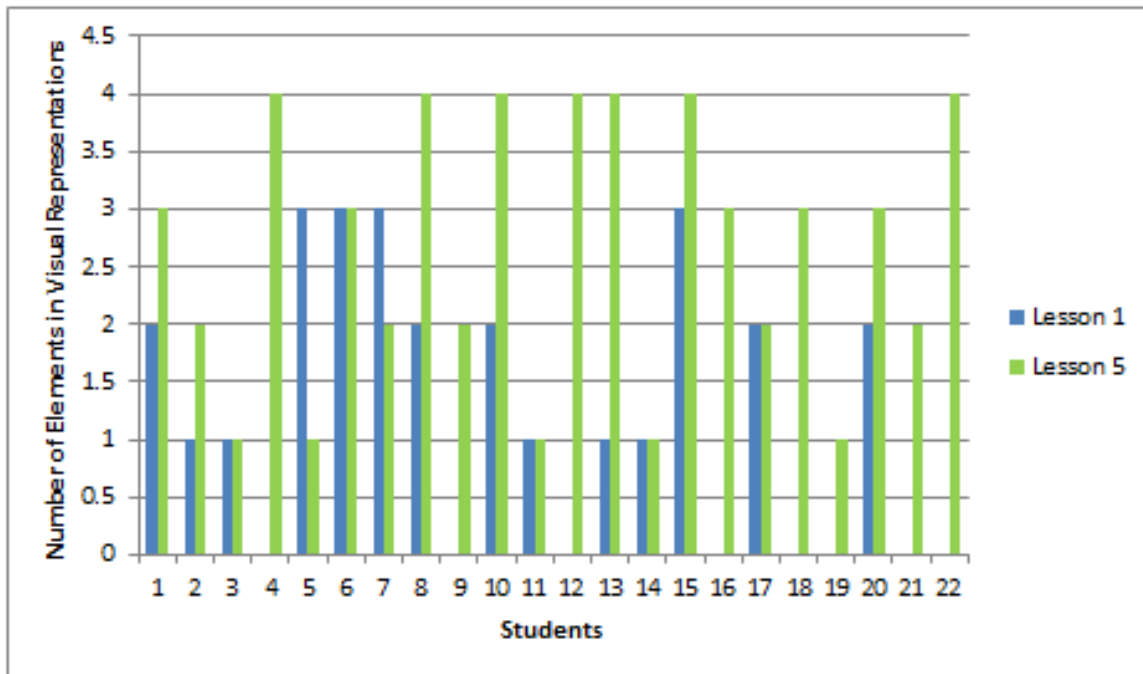


Figure 13. PLAN group sophistication scores comparison on fourth-grade visual representation assessments.

The number of elements present on lesson one visuals ranged from zero to three. Eight students' visuals included no elements, five students' visuals included one element, five students' visuals included two elements, and four students' visuals included three elements. Lesson five visuals scores ranged from one to four. Five students' visuals included one element, five students' visuals included two elements, five students' visuals included three elements, and seven students' visuals included four elements. Comparing the scores prior to PLAN instruction to following plan instruction, two students' scores decreased, fifteen students' scores increased, and five showed no change.

Data were also collected on the sophistication of visual representations for the PLAN + visuals group. Table 9 shows the elements present or absent from visuals in the PLAN + visuals group.

TABLE 9

PLAN + VISUALS GROUP VISUAL REPRESENTATION ELEMENTS

PLAN + Visuals Group	Visual Elements Lesson 1							Visual Elements Lesson 5							
	Student	Caption	Label	Heading	Rule	Box	Arrow/ Line	Total	Caption	Label	Heading	Rule	Box	Arrow/ Line	Total
B1								0		X				X	2
B2								0		X	X	X		X	4
B3								0			X	X			2
B4	X	X				X		3	X	X	X	X		X	5
B5		X				X		2		X	X	X			3
B6	X	X						2		X					1
B7								0		X					1
B8								0		X				X	2
B9								0		X	X	X			3
B10	X	X			X	X		4			X	X			2
B11								0		X	X	X			3
B12		X				X		2	X	X		X		X	4
B13	X					X		2		X				X	2
B14	X	X						2	X						1
B15		X	X		X			3		X	X	X		X	4
B16								0			X	X			2
B17	X	X	X			X		4	X		X	X		X	4
B18								0		X				X	2
B19	X							1	X	X				X	3
B20		X				X		2		X					1
B21	X	X			X	X		4	X		X	X		X	4
B22		X				X		2	X	X	X	X		X	5
Total	8	11	2	0	3	9		33	7	16	12	13	0	12	60

Visual elements data was analyzed in the same manner for the PLAN + visuals group, showing the comparison of scores between lesson one and lesson five on an individual basis. Figure 14 shows the results for these two phases of instruction.

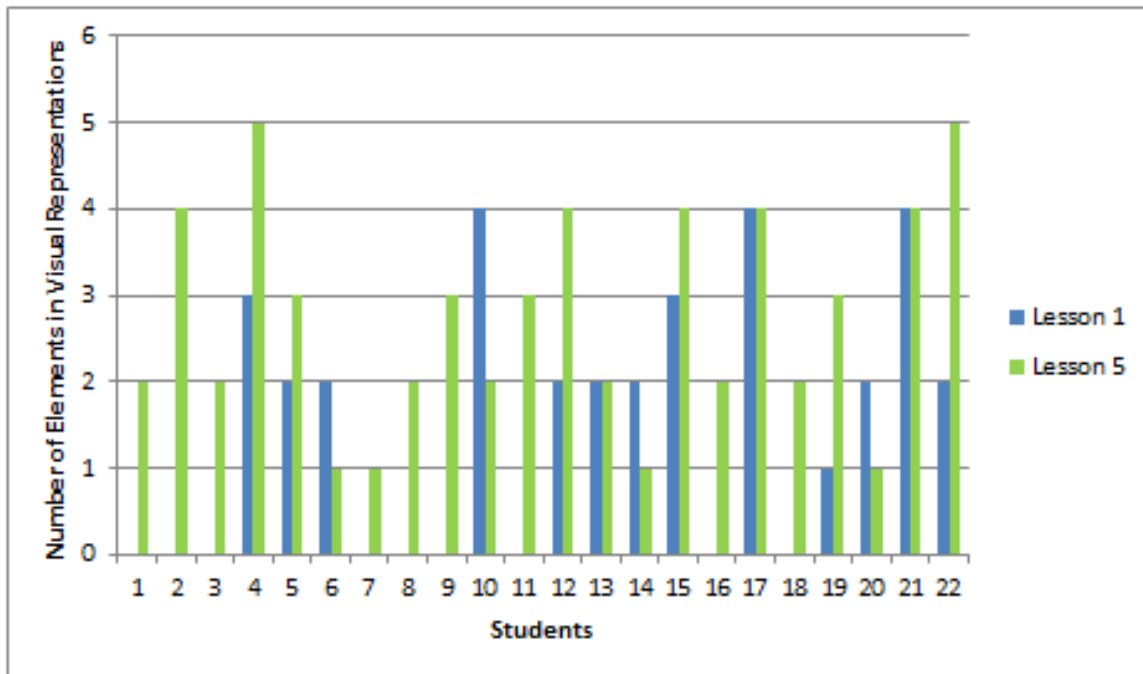


Figure 14. PLAN + visuals group sophistication scores comparison on fourth-grade visual representation assessments.

The number of elements present on lesson one visuals ranged from zero to four. Nine students' visuals included no elements, one student's visual included one element, seven students' visuals included two elements, two students' visuals included three elements, and three students' visuals included four elements. Lesson five visuals scores ranged from one to five. Four students' visuals included one element, seven students' visuals included two elements, four students' visuals included three elements, five students' visuals included four elements, and two students' visuals included five elements. Comparing the scores prior to PLAN instruction to following plan instruction, four students' scores decreased, fifteen students' scores increased, and three showed no change.

Data was not only compared within groups, but between the PLAN group and the PLAN + visuals group. Mean element scores for each group were calculated to examine whether addition visual representation instruction in the PLAN + visuals group impacted the

sophistication of students' self-created visuals. Figure 15 shows the comparison of these two groups.

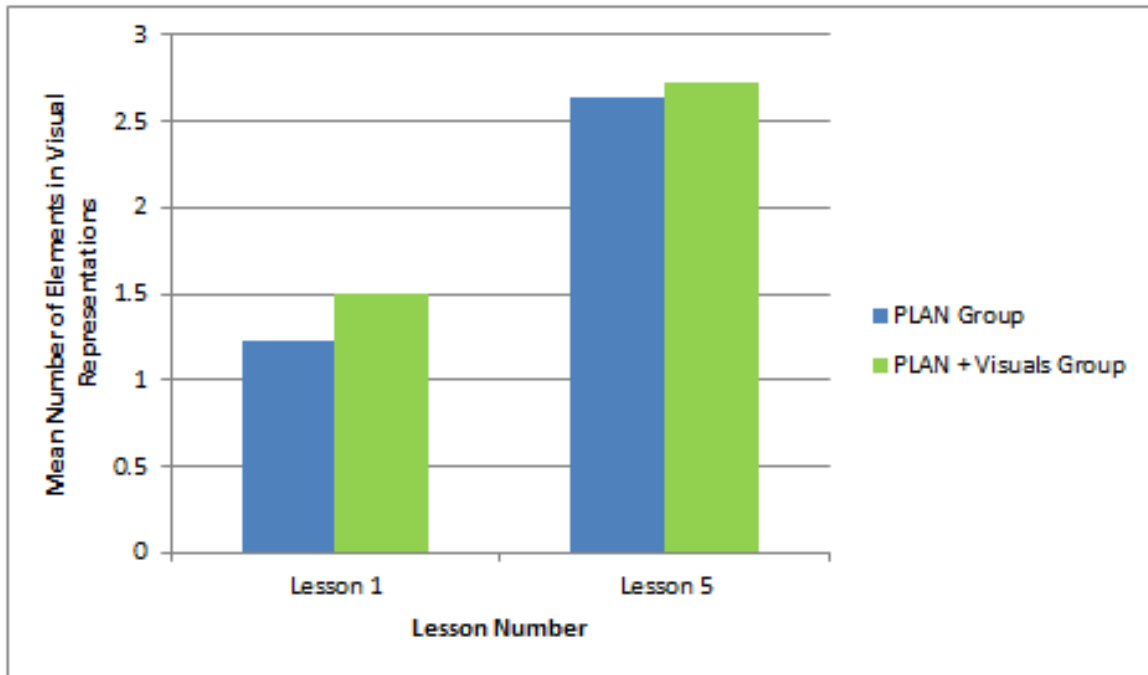


Figure 15. Mean sophistication scores comparison on fourth-grade visual representation assessments.

Lesson one shows the mean scores of each group prior to instruction in the PLAN text-mapping strategy. The PLAN group showed a mean score of 1.23, and the PLAN + visuals group showed a mean score of 1.50, a difference of 0.27 between the two groups. Lesson five shows the mean scores of each group after instruction in and the use of the PLAN text-mapping strategy, with additional visual representation instruction in the PLAN + visuals group. The PLAN group showed a mean score of 2.64, and the PLAN + visuals group showed a mean score of 2.73, a difference of 0.09 between the two groups. The PLAN group students increased their mean score by 1.41, and the PLAN + visuals group students increased their mean score by 1.23.

Last, data were compared within each group between students who were and were not identified as performing below grade level on prior school reading assessments. This was done to evaluate whether reading performance influenced the effectiveness of PLAN on the sophistication of students' visual representations. Figure 16 shows the results of this comparison for the PLAN group.

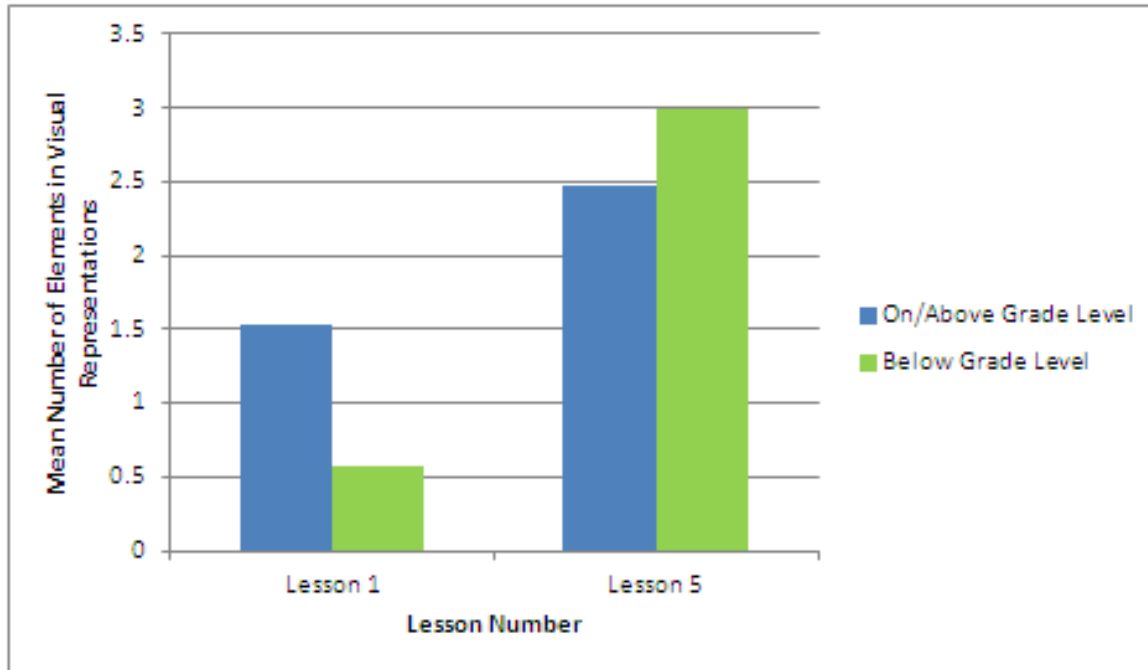


Figure 16. PLAN group mean sophistication scores comparison on fourth-grade visual representation assessments.

Lesson one shows the mean score of each group prior to instruction in the PLAN text-mapping strategy. Students on or above grade level showed a mean score of 1.53, and students below grade level showed a mean score of 0.57, a difference of 0.96 between the two groups. Lesson five shows the mean score of each group after instruction in and the use of the PLAN text-mapping strategy. Students on or above grade level showed a mean score of 2.47, and students below grade level showed a mean score of 3.00, a difference of 0.53 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level

students increased their mean score by 0.93. Below-grade-level students increased their mean score by 2.43 from the first lesson to the fifth lesson.

Figure 17 shows the results of the comparison between on- or above-grade-level students and below-grade-level students for the PLAN + visuals group.

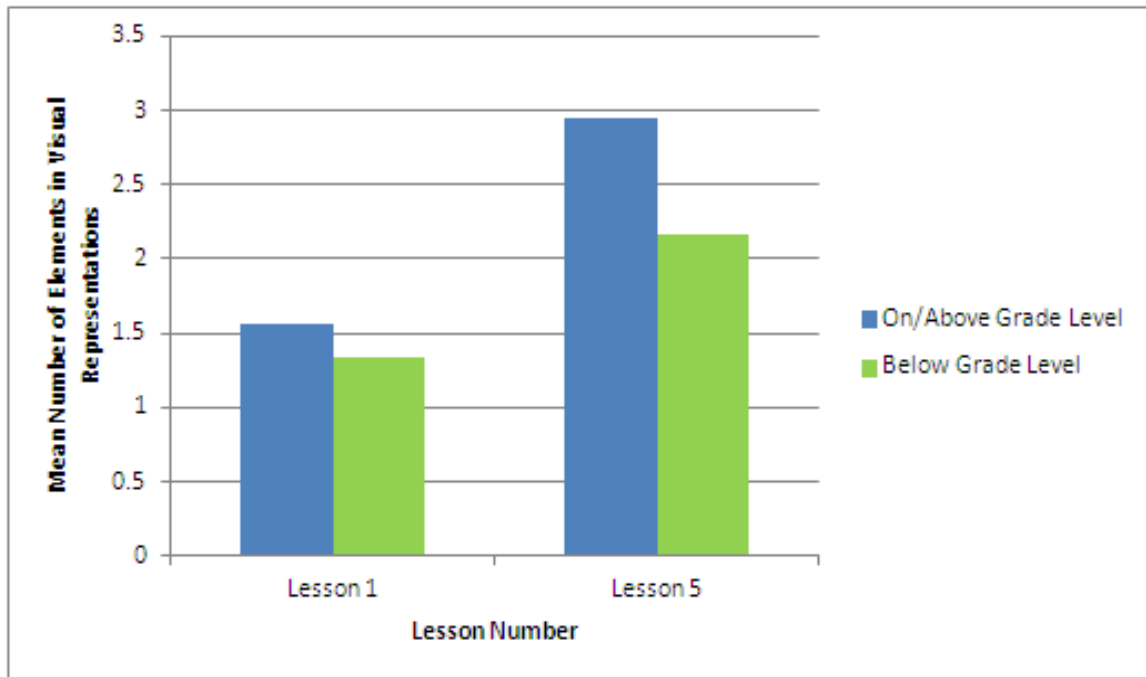


Figure 17. PLAN + visuals group mean sophistication scores comparison on fourth-grade visual representation assessments.

For lesson one, students on or above grade level showed a mean score of 1.56, and students below grade level showed a mean score of 1.33, a difference of 0.23 between the two groups. On lesson five, students on or above grade level showed a mean score of 2.94, and students below grade level showed a mean score of 2.17, a difference of 0.77 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level students increased their mean score by 1.38. Below-grade-level students' mean score increased by 0.84 from the first lesson to the fifth lesson.

In addition to type and complexity, students' representations were also examined based on the accuracy of the information present in the images. For each of the prompts, certain elements should have been present in the students' visuals in order to clearly communicate the concepts to the reader. The visual prompt from lesson one asked students to show the effects of Earth's rotation. Because of this, it was reasonable to expect the following elements to be present in their representations: Earth, the sun, rotation, day, and night. The visual prompt from lesson five asked students to illustrate the difference between a meteor and a meteorite. Therefore, visuals for this lesson were expected to include the following: a meteor, a meteorite, Earth, the meteor burning, the meteorite making contact with Earth's surface. The expected elements from lesson one and lesson five had to be represented clearly enough that a reader familiar with the prompt could identify the elements. The presence of lesson one and lesson five elements in students' visual representations was individually recorded for the PLAN group (Table 10) and the PLAN + visuals group (Table 11).

TABLE 10

PLAN GROUP ELEMENTS OF ACCURACY

PLAN Group	Visual Elements Lesson 1						Visual Elements Lesson 5					
	Student	Earth	Sun	Rotation	Day	Night	Total	Meteor	Meteorite	Earth	Burning	Impact with Surface
1	X	X				2	X	X	X		X	4
2	X	X		X	X	4	X	X	X	X	X	5
3	X	X	X	X	X	5	X	X		X	X	4
4	X	X				2	X	X	X		X	4
5	X	X		X	X	4	X	X	X			3
6	X	X	X	X	X	5	X	X		X	X	4
7	X	X		X	X	4	X	X	X	X	X	5
8	X	X				2	X	X			X	3
9	X	X				2	X	X	X	X	X	5
10	X	X				2	X	X	X	X		4
11	X	X				2	X	X				2
12	X	X		X	X	4	X	X			X	3
13	X	X	X			3	X	X	X	X	X	5
14	X	X		X	X	4	X	X	X	X	X	5
15	X	X				2	X	X	X		X	4
16	X	X				2	X	X				2
17	X	X		X	X	4	X	X	X	X		4
18	X	X				2	X	X	X	X	X	5
19	X	X				2	X	X	X	X	X	5
20	X	X		X	X	4	X	X	X	X	X	5
21	X	X				2	X	X		X		3
22	X	X		X	X	4	X	X	X			3
Total	22	22	3	10	10	67	22	22	15	13	15	87

TABLE 11

PLAN + VISUALS GROUP ELEMENTS OF ACCURACY

PLAN + Visuals Group	Visual Elements Lesson 1						Visual Elements Lesson 5					
	Student	Earth	Sun	Rotation	Day	Night	Total	Meteor	Meteorite	Earth	Burning	Impact with Surface
1	X					1	X	X				2
2	X	X				2	X	X	X		X	4
3	X	X		X	X	4	X	X	X	X	X	5
4	X	X	X	X	X	5	X	X	X		X	4
5	X	X		X	X	4	X	X	X		X	4
6	X	X		X	X	4	X	X				2
7	X	X				2	X	X				2
8	X	X		X	X	4	X	X	X			3
9	X	X		X	X	4	X	X	X	X	X	5
10	X	X		X	X	4	X	X		X	X	4
11	X			X	X	3	X	X	X		X	4
12	X	X				2	X	X			X	3
13	X	X				2	X	X				2
14	X	X	X			3	X	X				2
15	X		X			2	X	X				2
16	X	X		X	X	4	X	X		X	X	4
17	X	X		X	X	4	X	X	X	X	X	5
18	X	X				2	X	X				2
19	X	X		X	X	4	X	X			X	3
20	X	X				2	X	X				2
21	X	X				2	X	X	X			3
22	X	X				2	X	X	X	X	X	5
Total	22	19	3	11	11	66	22	22	10	6	12	72

Using the data from Table 10, the accuracy of the images between the first lesson and the fifth lesson were individually compared in the PLAN group to assess the impact of text mapping on students' ability to correctly convey information visually. The results are shown in Figure 18.

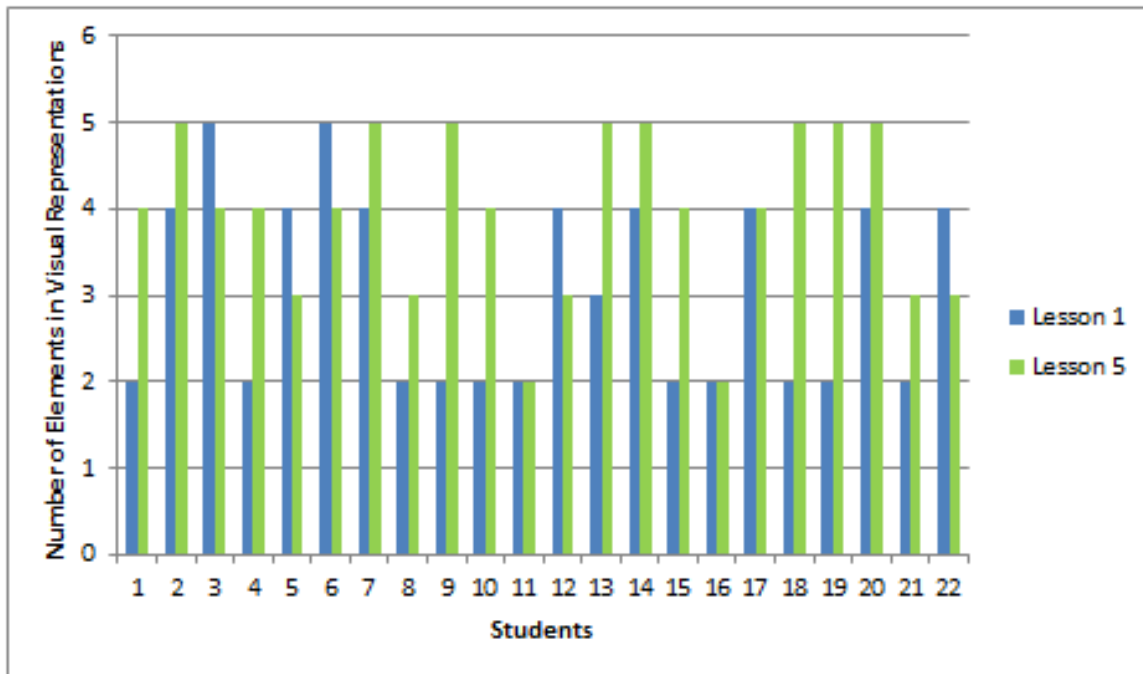


Figure 18. PLAN group comparison of accuracy on fourth-grade visual representation assessments.

Lesson one scores ranged from two to five. Eleven students' visuals contained two elements, one student's visual had three, eight students' visuals had four, and two students' visuals had five. Lesson five scores ranged from two to five as well. Two students' images contained two elements, five students' images had three, seven students' images had four, and eight students' images had five. Evaluating scores prior to PLAN instruction to following plan instruction, five students' score decreased, fourteen students' score increased, and three students showed no change.

Using data from Table 11, the accuracy of students' visual representations was compare in the same manner for the PLAN + visuals group. Figure 19 shows the results.

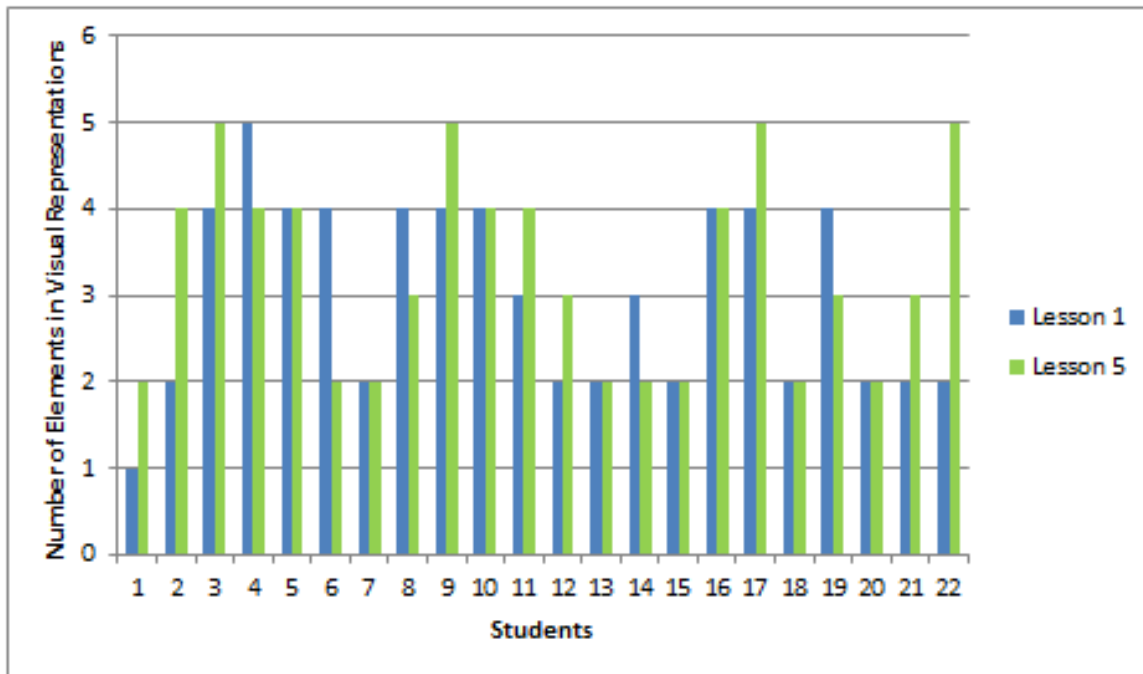


Figure 19. PLAN + visuals group comparison of accuracy on fourth-grade visual representation assessments.

Lesson one scores ranged from one to five. One student’s visual representation contained one element, nine students’ visuals had two, two students’ visuals had three, nine students’ visuals had four, and one student’s visual had five. Lesson five scores ranged from two to five. Eight students’ images had two elements, four students’ images had three, six students’ images had four, and four students’ had five. Going from the first lesson prior to PLAN instruction to the fifth lesson after PLAN instruction, five students’ scores decreased, nine increased, and eight showed no change.

Data on accuracy was not only compared within groups, but between the PLAN group and the PLAN + visuals group. Mean scores for each group were calculated to examine whether addition visual representation instruction in the PLAN + visuals group impacted the accuracy of students’ images. Figure 20 shows the comparison of these two groups.

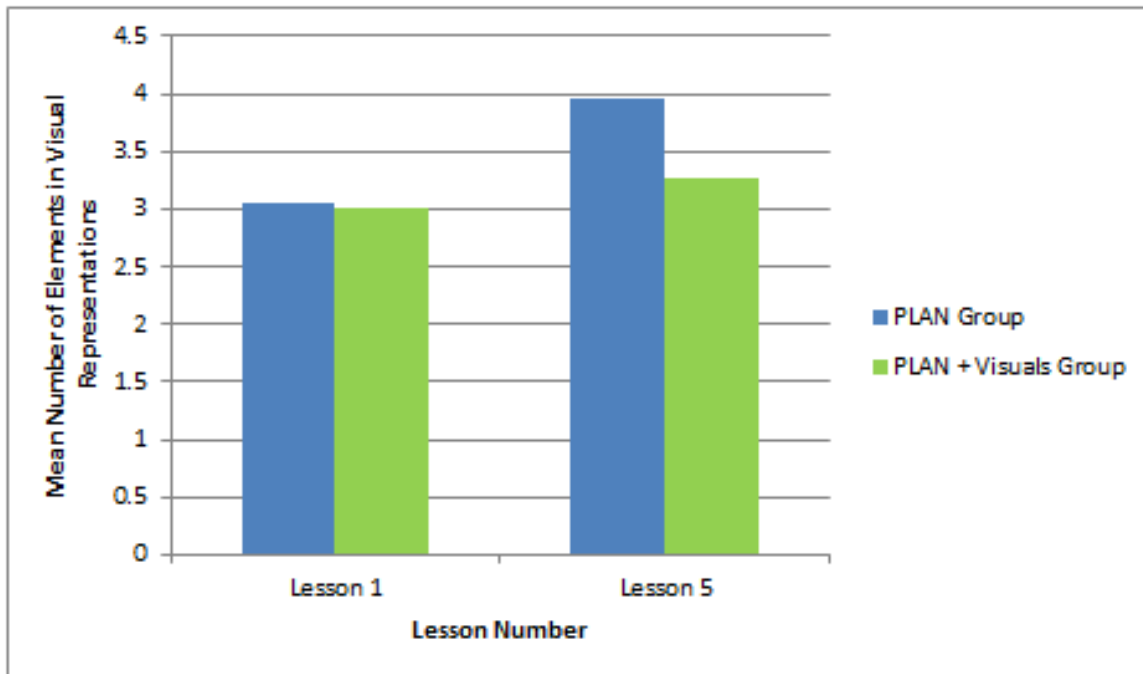


Figure 20. Mean accuracy scores comparison on fourth-grade visual representation assessments.

Lesson one shows the mean scores of each group prior to instruction in the PLAN text-mapping strategy. The PLAN group showed a mean score of 3.05, and the PLAN + visuals group showed a mean score of 3.00, a difference of 0.05 between the two groups. Lesson five shows the mean scores of each group after instruction in and the use of the PLAN text-mapping strategy, with additional visual representation instruction in the PLAN + visuals group. The PLAN group showed a mean score of 3.95, and the PLAN + visuals group showed a mean score of 3.27, a difference of 0.68 between the two groups. The PLAN group students increased their mean score by 0.90, and the PLAN + visuals group students increased their mean score by 0.27.

The final comparisons of accuracy were done within each group between students who were and were not identified as performing below grade level on prior school reading assessments. This was done to evaluate whether reading performance influenced the impact

of PLAN on the accuracy of students' visual representations. Figure 21 shows the results of this comparison for the PLAN group.

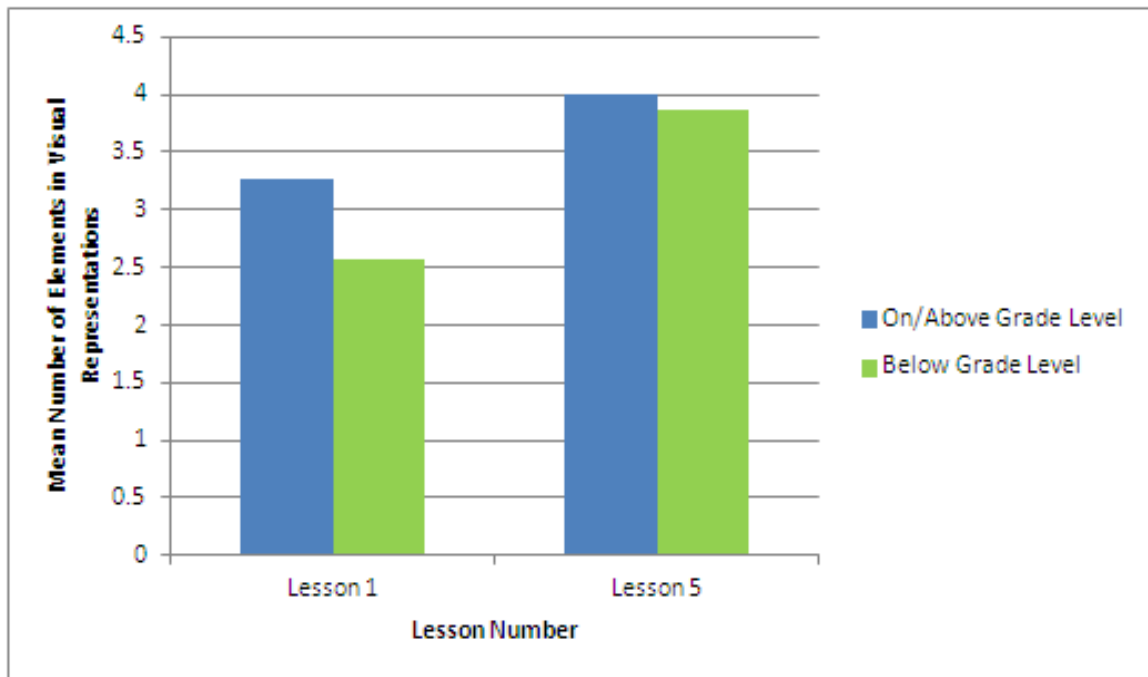


Figure 21. PLAN group mean accuracy scores comparison on fourth-grade visual representations assessments.

Lesson one shows the mean score of each group prior to instruction in the PLAN text-mapping strategy. Students on or above grade level showed a mean score of 3.27, and students below grade level showed a mean score of 2.57, a difference of 0.70 between the two groups. Lesson five shows the mean score of each group after instruction in and the use of the PLAN text-mapping strategy. Students on or above grade level showed a mean score of 4.00, and students below grade level showed a mean score of 3.86, a difference of 0.14 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level students increased their mean score by 0.73. Below-grade-level students increased their mean score by 1.29 from the first lesson to the fifth lesson.

Figure 22 shows the results of the accuracy score comparison between on- or above-grade-level students and below-grade-level students for the PLAN + visuals group.

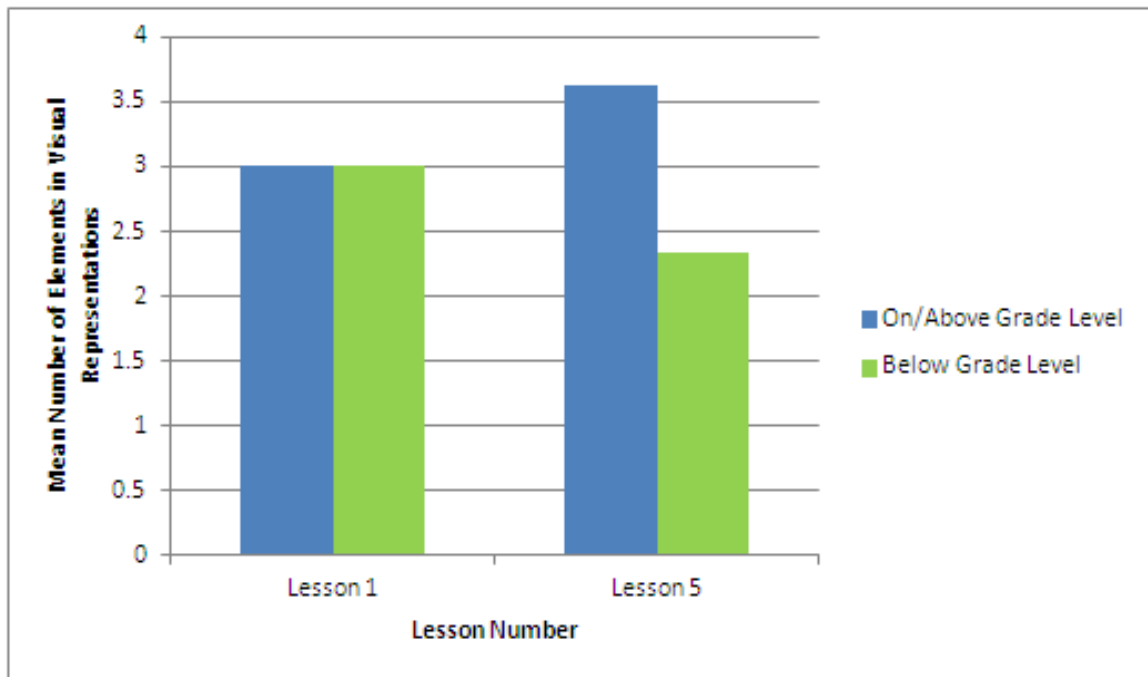


Figure 22. PLAN + visuals group mean accuracy scores comparison on fourth-grade visual representation assessments.

For lesson one, students on or above grade level showed a mean score of 3.00, and students below grade level showed a mean score of 3.00, a difference of zero between the two groups. On lesson five, students on or above grade level showed a mean score of 3.63, and students below grade level showed a mean score of 2.33, a difference of 1.30 between the two groups. From the first lesson to the fifth lesson, on- or above-grade-level students increased their mean score by 0.63. Below-grade-level students' mean score decreased by 0.67 from the first lesson to the fifth lesson.

CHAPTER 5

DISCUSSION

Summary

This study explored whether instruction in the use of the PLAN text-mapping strategy would improve the ability of fourth-grade students to comprehend and visually represent expository text. Based on data for both groups in the study prior to PLAN instruction and following PLAN instruction, PLAN shows a positive impact on students' overall comprehension of expository text and the sophistication and accuracy of their visual representations. Results of PLAN were mixed when assessing the impact on below-grade-level readers. The PLAN group below-level students made gains in comprehension and visual sophistication and accuracy. While the PLAN + visuals group below-level readers improved in visual sophistication, their scores decreased in the areas of comprehension and visual accuracy. The additional visual instruction in the PLAN + visuals group demonstrated no impact on the comprehension or visual representation abilities of the students.

Conclusions

A number of conclusions can be inferred from this study. First, in accordance with Caverly et al. (1995), Lapp et al. (2010), and Spencer (2003), text mapping was found to have a positive impact on student comprehension while reading informational text. Overall, a majority of individual students increased their free-response gain scores and showed fewer negative or zero gain scores following PLAN instruction. This demonstrates that text mapping can still be a relevant strategy while using expository text in the classroom under new CCSS.

Also, PLAN presented potential to assist students in transferring knowledge into visual representations. After PLAN instruction, students' visuals as a group contained a

greater amount of accurate information, and a majority of individual students increased the number of accurate elements within their images. Since a majority of the students demonstrated an increased comprehension of text concepts while using PLAN, an increase in those concepts being correctly represented in their visual representations could be expected to correlate. PLAN also appeared to aid students in the inclusion of text features and graphic design elements in their images. Following text-mapping instruction, the PLAN + visuals group nearly doubled the total number of text features/graphic design elements present in their visuals, and the PLAN group more than doubled the total number of text/features/graphic design elements present in their images. A majority of individuals in each group also increased the number of included elements. However, attributing this solely to PLAN instruction may not be accurate. Students may simply have been able to produce more of these features as their exposure to these elements through continued nonfiction reading increased, as suggested by Duke and Kays (1998, as cited in Duke, 2000, p. 206).

Despite the apparent success of PLAN, there were also shortcomings found in the data. The Caverly et al. (1995) study showed the potential PLAN held for increasing comprehension with college and middle school learners with reading difficulties. This study had varied results when comparing the success of PLAN among on-level and below-level readers. The PLAN group below-level students increased their mean scores more than their on-level peers from lesson one to lesson five in the areas of comprehension and visual sophistication and accuracy. In the case of visual sophistication, they actually outscored on-level students on the posttest for lesson five. However, the PLAN + visuals group struggling readers only managed to increase their mean score in the area of visual sophistication. Their comprehension visual accuracy mean scores decreased from lesson one to lesson five. The question to be asked, then, is why was one group's students noticeably more successful than the other? One answer might be related to student absence skewing data. Of all the below-

level students in the PLAN group, only one student was absent for more than one day, and this student only missed one day during PLAN instruction or use. In the PLAN + visuals group, however, there were two students who were absent multiple times. One of these students was gone multiple days during the last phase of this study. On the lesson five posttest, these two students accounted for two of the three lowest below-level comprehension gain scores, the two lowest below-level visual sophistication scores, and were in the lowest group for visual accuracy. Their scores do not reflect the success other below-level students had in this group.

In addition to varied success based on reading levels, PLAN was also problematic as an independent strategy. As stated by Reid & Lienemann (2006, as cited in Hagaman & Reid, 2008, p. 221) and Williams (2002, as cited in Hagaman & Reid, 2008, p. 223), students in this study frequently sought assistance during instruction phases where PLAN was being implemented. Questions were asked regarding simple matters such as the size of graphic organizers and word selection for organizer headings to the complex issues of determining text structure and identifying key points of the lesson. Student frustration with PLAN was nearly palpable at times, especially when they encountered lengthy texts and/or multiple text structures within one lesson. Students had difficulty maintaining focus and motivation with a strategy that required so much time. During lesson one, students were able to read the lesson and complete the posttest in one, thirty-minute class setting. Most students during lesson five took at least two hours to read the lesson in conjunction with PLAN and complete the posttest. Considering PLAN's former use in middle school and college classes, independent use may have been easier to achieve than in an elementary setting.

The necessary time to use PLAN in the classroom would not only be potentially trying for students, but problematic for teachers as well. The study was initially outlined to take twenty, thirty-minute sessions. When actually implemented in the classroom, the study

took twenty-four, thirty-minute sessions (see Appendix W). All additional days in the study were due to more time required by the students to complete the PLAN text maps for the lesson they were reading. Even after twenty-four days of nonfiction instruction, many students were not completing the phases of PLAN independently as directed in the Caverly et al. (1995) study. If this were to become a strategy teachers could expect all students to use correctly, independently, and successfully, a substantial amount of time would have to be devoted to nonfiction and PLAN instruction. Given the time constraints and curricular expectations placed on teachers in the classroom, this may be asking too much. However, given the need for these skills to successfully address the evermore challenging standards, the time may be necessary.

Beyond PLAN instruction, conclusions were also made concerning the additional visual representation instruction in the PLAN + visuals group during this study. In contrast with the findings of Coleman et al. (2012), visual instruction did not appear to impact the ability of the PLAN + visuals group as compared with the PLAN group to visually represent information based on data collected. On the other hand, these results may have more to do with the instruction they received than the abilities of the students themselves. As many other studies have found, student experience with expository text is often not effectively supported by teachers (Applebee, Langer, Mullis, Latham, & Gentile, 1994, as cited in Duke, 2000, p. 202; Daniels, 1990, as cited in Duke, 2000, p. 202; Langer, Applebee, Mullis, & Foertsch, 1990, as cited in Duke, 2000, p. 202; Alfassi, 2004, as cited in Hagaman & Reid, 2008, p.223). These expository texts not only contain written information, but visual information as well. Knowing how to instruct students to comprehend images plays a role in their overall comprehension of the material. Students receiving additional visual instruction in this study received limited instructional information on the visuals present in the lessons. While visual types and text features may have been discussed, detailed information, such as when to use

certain types of images, the specific and varied uses of text features, and elements of graphic design, was not provided to students. With little to guide them, few students in the PLAN + visuals group actually chose to represent information visually in their text maps. Students may not have felt confident in their drawing abilities without this guidance. If students had practiced selecting appropriate visuals for various types of information, and creating visuals and receiving feedback on them more frequently prior to final phase instruction, a greater change in the type, appropriateness, and specificity within the graphic may have been visible in their representations. Moline (2012) was used as a source on visual literacy following PLAN instruction in order to aid in the analysis of visual representations. Perhaps far more effective would have been the use of this resource prior to providing students with visual representation instruction. Truly, instruction on visual representation should become a requirement for all students and teachers.

Limitations

Some limitations of this study should be noted. First, this study was conducted with a small population in a specific location. The population of students in the two groups in this study may not be representative of other fourth-grade classrooms in the district. The study was also conducted in a suburban school, which often does not serve the same population of students that may be present in an urban setting. The socioeconomic status of the students and school in the study may have influenced PLAN results. Research in other geographic areas with a larger, more diverse set of students may need to be explored. The use of PLAN could yield different results when used with a larger, more diverse set of students in other geographic areas.

Another limitation of this study was the materials used for nonfiction instruction. Students used a science textbook that covered one specific unit while creating PLAN text maps. The adoption of this textbook took place many years ago, and some of the information

present in the book was outdated and perhaps not representative of the expository text students are more likely to encounter in more up-to-date classrooms. Considering that only science lessons were used during this study, student aptitude in this subject area could have influenced the overall effectiveness of PLAN. Other nonfiction text resources that cover different subject areas could also be explored.

A final limitation of this study was the amount of time PLAN was used. Students were given a short period of time to practice using PLAN and creating visual representations before the conclusion of this study. Furthermore, students had limited exposure to informational text and visual representations prior to this study. Much of their expository instruction took place during short segments of class time and on an irregular basis. Having more time to practice PLAN and analyzing and creating images could produce greater results.

Future Research

Considering that literacy in the twenty-first century increasingly relies on the use of technology, further research is necessary to determine effective strategies for nonfiction comprehension when using the plethora of available digital resources. As this technology emerges in classrooms, the complexity of digitally presented information versus printed information will impact how instruction needs to be delivered to students.

Also related to this, strategies for teaching visual literacy and production need to be explored in future studies. Ever-changing technology continues to create new ways of viewing information in a variety of formats. With the adoption of CCSS, students will be expected to utilize these tools in the comprehension, creation, and presentation of visual information. If students are to be prepared for future career expectations, teachers themselves will need to be visually literate, familiar with available technology, and prepared to communicate this knowledge successfully with their students.

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APPENDIXES

Appendix A


Proposed Instructional Time Table

PHASE 1				
Day 1	Day 2	Day 3	Day 4	Day 5
<ul style="list-style-type: none"> Promethean text features introduction 	<ul style="list-style-type: none"> Reading textbook text features activity 	<ul style="list-style-type: none"> Science textbook text features activity 	<ul style="list-style-type: none"> Scholastic News text features activity 	<ul style="list-style-type: none"> Kagan Quiz, Quiz, Trade Promethean text features quiz
PHASE 2		PHASE 3		
Day 6	Day 7	Day 8	Day 9	Day 10
<ul style="list-style-type: none"> Pretest lesson 1: <i>Movements of the Solar System</i> 	<ul style="list-style-type: none"> Read lesson 1 Posttest lesson 1 	<ul style="list-style-type: none"> Read <i>Dear Mr. President</i> (cause and effect) Complete graphic organizer 	<ul style="list-style-type: none"> Read <i>Colonial Life versus Life Today</i> (compare and contrast) Complete graphic organizer 	<ul style="list-style-type: none"> Read <i>Lucky Shot!</i> (description) Complete graphic organizer
PHASE 4				
Day 11	Day 12	Day 13	Day 14	Day 15
<ul style="list-style-type: none"> Introduce PLAN 	<ul style="list-style-type: none"> Read lesson 2: <i>What Are the Effects of the Moon's Movement?</i> Begin PLAN with whole class 	<ul style="list-style-type: none"> Complete PLAN for lesson 2 	<ul style="list-style-type: none"> Read lesson 3: <i>How Does Earth Compare with Other Planets?</i> Begin PLAN with partners 	<ul style="list-style-type: none"> Complete PLAN for lesson 3
PHASE 4		PHASE 5		
Day 16	Day 17	Day 18	Day 19	Day 20
<ul style="list-style-type: none"> Read lesson 4: <i>What Have Scientists Learned About Distant Planets?</i> Begin PLAN individually 	<ul style="list-style-type: none"> Complete PLAN for lesson 4 	<ul style="list-style-type: none"> Pretest lesson 5: <i>What Other Objects Are Seen in the Solar System?</i> 	<ul style="list-style-type: none"> Read lesson 5 Complete PLAN individually 	<ul style="list-style-type: none"> Posttest lesson 5

Appendix B




Text Features Flipchart



 BrainPOP Jr
©BrainPOP

- title
- table of contents
- pictures/illustrations
- boldface type
- glossary
- index
- labels
- captions

Text features are found in many places!

 books	 maps	 newspapers	charts diaries magazines
--	---	--	--------------------------------

The title tells you what the piece of writing is about.



*All About
Snakes*

The Table of Contents helps the reader locate information within the book.

Contents

Introduction	06
Indian Culture	08
Domination in 40 years 1765-1805	09
Bedrock Mortar	10
Acorns and Other Food Sources	11
Stone Circles and Walls	12
Ceremonial Sites	13
The Big Picture	14
What Can We Learn?	15
Restoring Culture and Society	16
Daylighting Sites	17
Private Property	18
The Opposing View	19
The Future	20
The Sites	21 - 50
Afterwords	60
Suggested Reading	61
Notes	62

A list of divisions (chapters or articles) and the pages on which they start.

Photo captions tell the reader about the photo.



This small pink fish has hands.



Maps help readers understand where things are in the world.



Labels help readers identify a picture or a photograph and its parts.



magic eraser

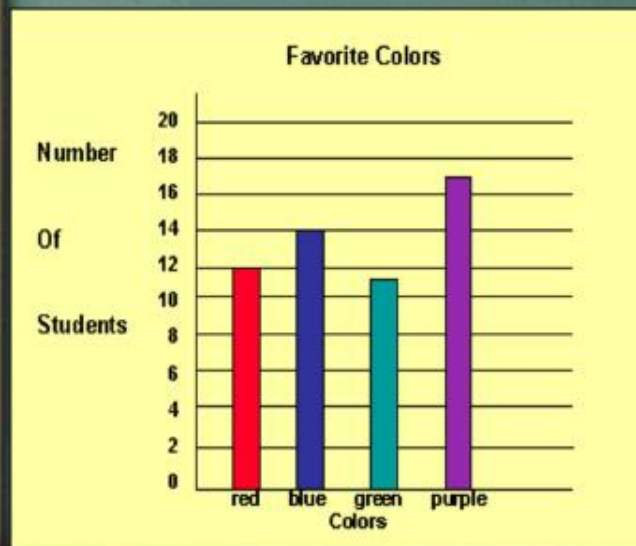


Charts organize information in a way that is easy for us to read and understand.

Charts have labels, too.

CHILDREN'S SIZE CHART					
Sizes	Height (inches)	Weight (lbs.)	Chest	Waist	Hip
2 (XS)	33-36	30-33	20	20	21
3 (XS)	36-39	33-36	21	20½	22
4 (S)	39-42	36-40	22	21	23
5 (S)	42-45	40-46	23	21½	24
6 (M)	45-49	48-54	24	22	25
7 (M)	49-53	56-60	25	22½	26
8 (L)	53-55	62-66	26½	23	28
10 (L)	55-57	68-74	28	24	30
12 (XL)	57-60	76-84	29½	25	32
14 (XL)	60-62	86-96	31	26	34

Graphs take information and create a picture that is easy to understand.





INDEX		Page No.
	About the Author	1
	Author's Note	5
	About the Book	10
Part 1	Introduction	11
	Part 1: Architecture	14
Part 2	Part 2: History	17
	Part 2: Temple Architecture	18
Part 3	Part 3: Style and Architecture	22
	Part 3: Modern Architecture	29
Part 4	Part 4: Differences between the Traditional and Modern Architecture	37
Part 5	Part 5: Combination of Traditional and Modern Architecture	53
Part 6	Part 6: Traditional Indian Temple Architecture	66
Part 7	Part 7: Indian Temple Architecture	77
Part 8	Part 8: Author's Architectural Projects	86
	List of References	155
	Acknowledgment	157
	Index	158

The index helps the reader find specific information without reading the entire book. It is usually found in the back of the book.

Italics or Boldface Type

Slanted text like this is written in italics. Text that looks darker than other text is in boldface type. We use italics and boldface type for emphasizing words, to introduce new vocabulary, and for titles of different things.

The farmer went to the *orchard* to pick some juicy, red apples!



Headings

and Subheadings

Headings tell you the main idea about a piece of writing.

The subheadings tell you supporting details for that topic.

- ◊ **Exercise**
 - ◊ **Why Exercise?**
 - ◊ **Feel better**
 - Increase energy
 - Enhance self-esteem
 - ◊ **Look better**
 - Lose weight
 - Tone muscles
 - ◊ **Live longer**
 - Lower cholesterol
 - Lower high blood pressure



Glossary

The glossary shows the definitions of words important to the piece of writing you are reading.



1. Which text feature helps the reader find information without reading the entire text?

A labels

B table of contents

C maps

D index



2. To find information about the topic on page 14, where would you look ?

A maps

B labels

C index

D photo captions



3. Which of the following helps the reader understand the size of objects?

- A maps
- B labels
- C comparisons
- D table of contents



4. Which text feature will help the reader understand what is happening here?

- A photo captions
- B football
- C index
- D labels





5. Which genre would you find the text features covered in this flipchart?

- A fairy tales
- B fiction
- C poems
- D nonfiction

Text Features Scavenger Hunt

Directions: Use your reading book to answer the questions about text features.

1. Find the table of contents at the beginning of the book. How many reading themes are in our textbook?

2. What are the first three stories found in Theme 3?

3. Find a picture with a caption in your book. Tell me the caption and the page you found it on.

4. Find the map that goes with the story *Akiak*. What page is it on?

5. What is the title of this map?

6. Look at the story *Cendrillon*. Give two words that are written in italics in the story?

7. Why do you think these words are italicized?

8. Find the glossary in your textbook. What is the definition of the word murmur?

9. Find the bolded vocabulary words for the story *The Last Dragon*. What are the six vocabulary words?

10. Find the story *Iceberg Right Ahead!* on page 104. What are the two subheadings for this story?

Appendix D

Text Features Worksheet – Science Textbook

TEXT FEATURES

Directions: Use your Science Text Book to find the following information.

1. What page does the *Glossary* start on?
2. What is the purpose of a glossary?
3. Using the Table of Contents, write down what Unit C, Chapter 2 is titled.
4. Turn to page C53. What does the caption say about the picture of animals and soil?
5. Find the picture of the hairdryer in the chapter about electricity and magnetism. What page is it on?
6. What does the caption say about the picture of the hairdryer?
7. Turn to page A97. What is the title of the line graph?

8. In what year is the highest number listed?

9. What page can the start of the Index be found?

10. Where would you find information on magnets?

11. Looking through your book you will find lots of words in **boldface** type. Why?

12. Give one example of a word in boldface type and its definition.

13. There are three subheadings in the lesson How Does Sunlight Affect Air Temperature? on pg. C8-C11. What are the three subheadings?

14. Look through the rest of the book. What chapter do you think is the most interesting? What is its title?

Scholastic News Text Features and Comprehension

Directions: Use this week's *Scholastic News* to find the following information.

What page does the Cover Story begin on?

How did you know?

What does the caption say about the picture on page 2?

Turn to page 16. What is the map showing you?

What are the three titles used for each column of the chart?

Find a page that shows a map. What page is it on? What is the purpose of the map?

Find the two boldface words in the story “Robots to the Rescue.”
What are the words?

Find the boldface word in the story on page 3. What is the word?
What is the definition of the word?

What are the four subheadings in the story “Robots to the Rescue?”

What is the red color showing in the map on page 14?

News Chart (pg. 16)

How much did *The Avengers* make in the U.S.?

How much more did *Avatar* make than *Star Wars*?

The original *Star Wars* and *Episode I – The Phantom Menace* made a combined total of...

News IQ: Pages 4-5 (pg. 16)

What is the main idea of “Robots to the Rescue?”

- A B C D

Based on what Viktor Orekhov says, what can you infer about firefighting robots?

A B C D

According to the article, how are the firefighting robot and the snake robot similar?

A B C D

Which of the following describes a humanoid?

A B C D

News IQ: Pages 6-9 (pg. 16)

According to the “Extreme Heat” section of the article, which statement is false?

A B C D

Which event happened after the death of Neil Armstrong but before the presidential election?

A B C D

Which word or phrase means nearly the same as *ambassador*?

A B C D


Appendix F

Kagan Quiz, Quiz, Trade Activity

QUIZ-QUIZ-TRADE
Activity

Comprehension Quizzes

Class plays Quiz-Quiz-Trade for repeated practice on text types, text structures, cause and effect, text features, homophones, word meanings, possessive nouns, and present and past tense verbs.



STRUCTURE
Quiz-Quiz-Trade

Activity Steps

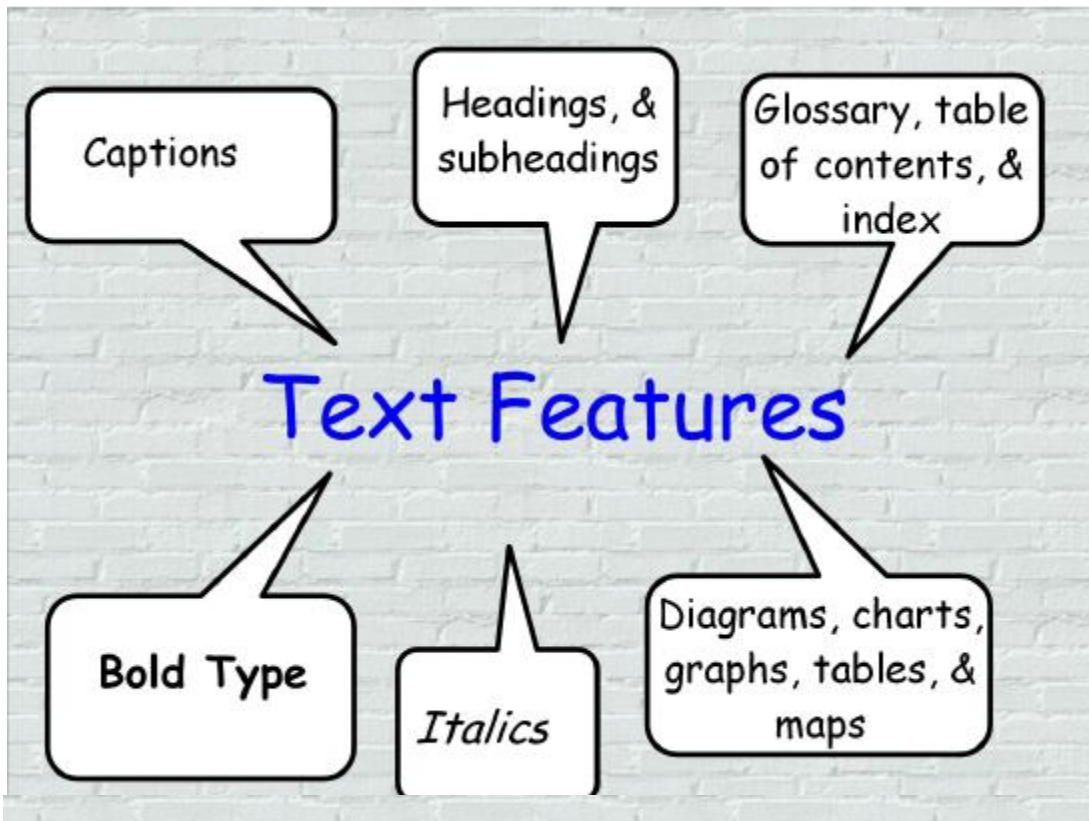
- 1) Each student receives a card with a question on the front and an answer on the back.
- 2) Students stand up, put a hand up, and pair up with another student.
- 3) Partner A quizzes Partner B using the card.
- 4) Partner B answers the question.
- 5) Partner A praises or coaches.
- 6) Partner B now quizzes Partner A, Partner A answers, and Partner B praises or coaches.
- 7) Partners trade cards and find a new partner to quiz. The activity continues for multiple rounds, allowing students to quiz and get quizzed multiple times.

Blacklines

• Text Types—Definitions.....	84–87
• Text Types—Author’s Purpose	88–95
• Text Types—Examples	96–102
• Determining Author’s Purpose and Text Types from Titles	103–110
• Text Structures—Definitions, Signal Words, and Graphic Organizers.....	112–118
• Text Structure Passages.....	119–123
• Cause and Effect	124–131
• Text Features	132–135
• Homophone Definitions.....	136–142
• Figurative Language.....	143–148
• Homophone Sentences.....	149–156
• Word Meanings.....	157–163
• Possessive Nouns.....	164–170
• Present and Past Tense Verbs.....	171–178

Appendix G

Text Features Quiz Flipchart



The words written in red are an example of _____.

- A bold face type
- B italics
- C a caption
- D a subheading



Here are two Siberian tigers fighting in the snow.

I am **really** hungry!

The word really is an example of

_____.

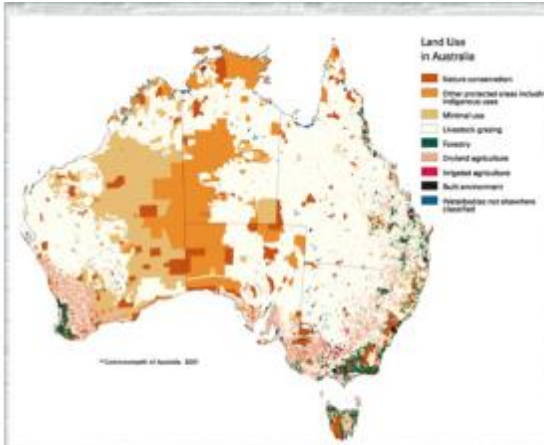
- A a chart
- B a table of contents
- C bold face type
- D italics

The farmer needed to *harvest* his crops to sell them.

The word harvest is an example of

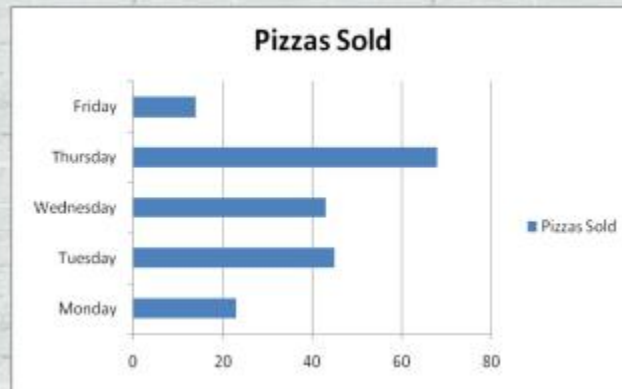
_____.

- A italics
- B a title
- C bold face type
- D a heading



This is an example of a _____.

- A chart
- B map
- C graph
- D illustration



This is an example of a _____.

- A chart
- B map
- C graph
- D index

The word giraffes is an example of _____.

- A a caption
- B italics
- C a subheading
- D a heading

Giraffes

Physical Description

A large animal with extremely long legs, a sloping back and a very long neck. They have a long muzzle and large eyes, medium-sized ears and bony horns on head (especially in adult males). The coat is short and sandy-colored with dark brown patches of varying intensities and shapes. They have a short, upright brown mane and a long dark tassel on tail, and cloven hooves.

Eating Habits

Giraffes are vegetarians. They eat mostly grass and leaves from trees. They reach high up into trees for their food.

The words physical description and eating habits are examples of _____.

- A captions
- B italics
- C subheadings
- D headings

Giraffes

Physical Description

A large animal with extremely long legs, a sloping back and a very long neck. They have a long muzzle and large eyes, medium-sized ears and bony horns on head (especially in adult males). The coat is short and sandy-colored with dark brown patches of varying intensities and shapes. They have a short, upright brown mane and a long dark tassel on tail, and cloven hooves.

Eating Habits

Giraffes are vegetarians. They eat mostly grass and leaves from trees. They reach high up into trees for their food.

cat family..... page 2,5,7
description of....page 2-5
eating habits.....page 14
facts about.....page 25-30
habitat.....page 6

This is an example of _____.

- A an index
- B a table of contents
- C a glossary
- D a map

den (noun) - a lair or shelter for a wild animal
habitat(noun) - a natural environment of an organism

This is an example of _____.

- A a table of contents
- B a glossary
- C an index
- D a chart

Types of Cats..... chapter 1
Habitats.... chapter 2
Big Cats..... chapter 3
Domestic Cats..... chapter 4
Eating Habits..... chapter 5

This is an example of _____.

- A a table of contents
- B a glossary
- C an index
- D bold face text



What Are the Effects of Earth's Movements?

Please answer the following questions.

1. What does the Earth spin on?
2. How long does it take for Earth to make one rotation?
3. What does the rotation of Earth cause?
4. What is the path of Earth as it moves around the sun called?

5. How long does it take for Earth to make one revolution around the sun?

6. What force causes Earth to revolve around the sun?

7. What does the tilt of Earth cause?

8. What would happen if Earth wasn't tilted?



You will learn:

- what the effects of Earth's rotation and revolution are.
- about the effects of Earth's tilt.

Glossary

Glossary

axis (ak'sis), an imaginary line through a spinning object

rotation (rō tā'shan), one full spin of an object around an axis

Lesson 1

What Are the Effects of Earth's Movements?

Sunrise! Sunset! You may have watched these events many times. But have you ever wondered what causes the sun to appear to rise and set? How would your life be different if the sun did not set?

Earth's Rotation and Revolution

Did you know that Earth is always moving? It never stands still. One way Earth moves is by spinning around its axis. It spins, or rotates, just like the ball in the picture. Imagine that you draw a line from the finger up through the ball. The ball is spinning around that line. Earth also spins around such a line, or **axis**. Each time Earth makes one full spin on its axis, it makes one **rotation**.

◀ Spin! Spin! Spin!
Unlike the basketball,
Earth never stops spinning.
Doesn't it make you dizzy
to think about that?

C9B

Notice in the picture that only the part of Earth facing the sun is lighted. This part of Earth has daytime. The part that is not lighted has nighttime. It takes Earth 24 hours, or a day, to make a rotation. So on Earth, we have both a daytime and a nighttime every 24 hours.

As Earth spins, it also moves, or revolves, around the sun. Just as you have a route, or path, that you follow to school, Earth moves in a path around the sun. The path of Earth is called its **orbit**. One full orbit around the sun is one **revolution**. Earth takes one year to make one revolution—that's about 365 days. Just think! Every time you celebrate a birthday, Earth has made another trip around the sun!

Gravity is a force of attraction that causes Earth to revolve around the sun. Without gravity, Earth would fly off into space! The force of gravity between Earth and the sun keeps Earth in its orbit.

Glossary

orbit (ôr'bit), the path of an object around another object

revolution (rev'ə lû'shan), the movement of an object around another object

Glossary

When you wake up to a bright sunrise, other parts of Earth are in darkness! ▼

Effect of Earth's Tilt

Notice the pictures below. They show how the tilt of Earth affects the way different parts of Earth receive sunlight. Notice the difference between the northern part of Earth and the southern part.

June to September

The northern part of Earth gets the most direct sunlight from June to September. During this time, the northern part of Earth has summer. ▼

December to March

The southern part of Earth is tilted toward the sun from December to March. During this time, the southern part of Earth gets the most direct sunlight. The southern part of Earth now has summer. ▼

▲ *The southern part of Earth gets more indirect sunlight when the northern part gets direct sunlight. So from June to September the southern part of Earth has winter. If you lived in Argentina at this time of the year, you could have fun in the snow!*

▲ *The northern part of Earth is tilted away from the sun from December to March. During this time, the northern part of Earth gets indirect sunlight. The northern part of Earth now has winter.*

C100

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Look at the picture on page C100 again. Notice how Earth is tilted when the northern part of Earth has summer. At this time the northern part of Earth gets more direct sunlight than the southern part.

Sunlight, as shown in the picture, is a form of the sun's energy. The more energy from the sun that reaches Earth, the more the sunlight heats Earth. Direct rays of sunlight are not spread out as much as indirect rays. Therefore, the energy of direct rays is not spread out as much and they heat Earth more.

Think about this. Suppose Earth's axis was straight up and down—not tilted. Then the direct sunlight would hit the same part of Earth all the time. The part of Earth near the equator would always have summer. The northern and southern parts of Earth would have milder weather all year long. So you can see, it is the tilt of Earth that causes the seasons to change.

▲ The picture shows the sun shining on the surface of Earth. Without the energy of sunlight, Earth would be very cold.

Lesson 1 Review

1. How does Earth's rotation cause days?
2. Why does the southern part of Earth have winter when the northern part has summer?

3. Predictions

How do you predict that days and nights on Earth would be different if Earth did not rotate on its axis?



What Are the Effects of Earth's Movements?

Please answer the following questions.

1. What does the Earth spin on?
2. How long does it take for Earth to make one rotation?
3. What does the rotation of Earth cause?
4. What is the path of Earth as it moves around the sun called?

5. How long does it take for Earth to make one revolution around the sun?

6. What force causes Earth to revolve around the sun?

7. What does the tilt of Earth cause?

8. What would happen if Earth wasn't tilted?

On the following page, create a visual image that shows the effects of Earth's rotation.

Cause and Effect Text Structure

Dear Mr. President

In 1860, 11-year-old *Grace Bedell* saw a picture of Abraham Lincoln and didn't like the way he looked. *Grace* wrote Lincoln a letter: "If you will let your whiskers grow...you would look so much better, for your face is thin." Lincoln took *Grace's* advice. He grew a beard.

Not every president takes a child's letter to heart, as Lincoln did. Below are just a couple of the thousands of letters kids have sent U.S. presidents over the years. These and other letters have been on display in November at the National Archives and Records Administration, in Washington, D.C.

Don't Draft My Dad

In 1943, at the height of World War II (1939-1945), 10-year-old *Carolyn Weatherhogg* wrote a letter to President Franklin D. Roosevelt: "I am sending in a suggestion, that is draft fathers alphabetically."

The government at the time was **drafting**, or ordering, people to serve in the military. *Carolyn* hoped that because her father's last name began with *W*, he wouldn't be drafted for a long time, according to her proposal.

There was no return address on the letter, and no one knows what happened to *Carolyn's* father. Roosevelt did not reply.

Rock 'n' Roll Haircut

In the 1950s, *Elvis Presley*, a young singer from Memphis, Tennessee, rocked the music world. In 1957, the U.S. government had other plans for *Presley*-- it drafted him into the U.S. Army. That decision did not sit well with many

of his fans. For example, three girls in Montana did not want the Army to give Presley the standard Army buzz haircut. They wrote a letter to President Dwight D. Eisenhower (1953-1961) hoping to stop the Army from cutting Presley's hair and sideburns: "We think [it's] bad enough to send Elvis Presley in the Army, but if you cut his sideburns off we will just die!"

An army barber eventually gave Presley the military-issue crew cut.

Compare and Contrast Text Structure

Colonial Life versus Life Today

People who lived during Colonial times had a very different life than we have today. For example, many of the city merchants were craftsmen, shoemakers, silversmiths, and blacksmiths. On the contrary, in cities today you can find large department stores, grocery stores, and even specialty stores, like music stores.

Homes had windows that were covered in paper rather than the glass we use today. Also, the medicines that they had were unlike the modern kinds that we have today.

Not everything is different, however. In colonial times, people planted vegetable gardens behind their homes. Similarly, many families today plant their own gardens to grow fresh vegetables. Colonial families ate the same foods as we do today, like chicken, turkey, oatmeal, and fruits. Colonial children played games like hide-and-go-seek, hopscotch, and checkers. Likewise, children today also play these games.

Description Text Structure

Lucky Shot!

The measles virus is spreading like wildfire in Africa. Now, a new program gives shots to elementary school students to stop the disease dead in its tracks.

Most kids hate getting shots, but not sixth grader Alseny Diallo. "I'm happy to get it," she said. "It only hurt a little bit."

Alseny lives in Guinea, a small, poor country in Africa. She got her shot from a nurse working for the Measles Initiative, a project sponsored by the American Red Cross.

The project protects millions of children in Africa from getting **measles**. Measles is a disease that causes a spotted rash, high fevers, and breathing problems. Chances are, if you grew up or live in the United States, you never had measles. But kids in Africa aren't as lucky.

To find out more about the project, *Weekly Reader* traveled to Guinea to see the Measles Initiative in action.

Saving Lives

Measles is **contagious**. In other words, the disease passes easily from person to person through the air. If a person is left untreated, the disease can cause blindness and brain damage. It can also be deadly. One African child a minute dies of measles.

While in Guinea, *Weekly Reader* talked to Mark Grabowsky, a doctor from the American Red Cross. "Measles is a rare disease in the United States now," he said.

That's because American kids get **vaccinations**. Vaccinations are shots containing **vaccines**, or medications, that protect people from getting certain diseases.

Through the Measles Initiative, the Red Cross hopes to make measles rare in Africa. So far, the group has vaccinated more than 100 million African children. By 2005, project members will have vaccinated 1.2 million African children. No wonder Alseny Diallo and her friends were happy to get their shots!

Kids Helping Out

Gregory Pendergast, 11, traveled with *Weekly Reader* to Guinea. His class at Caroline Elementary School in Ithaca, N.Y., raised almost \$800 for the Measles Initiative.

The American Red Cross invited Greg, his mom, and his teacher to visit Guinea to see the project in action. He visited an African school and presented the students with a book that he and his classmates had made about their lives in the United States.

He also gave them candy and pencils--rare treats in poverty-stricken Guinea.

"When you're making a difference, you feel so good about yourself," Greg said.

Appendix L

Text Structure Graphic Organizers

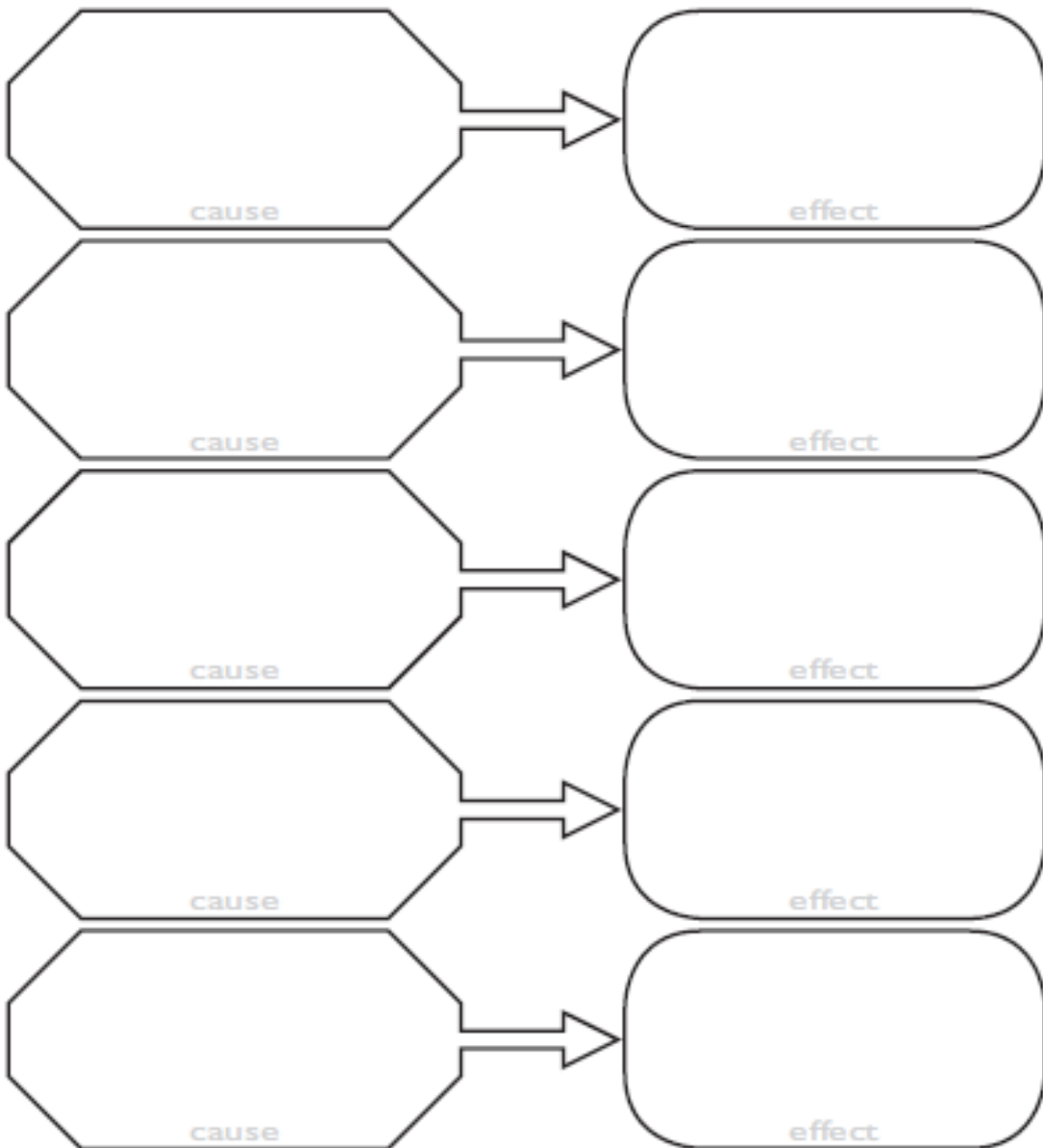
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Text Structure Reflection

C.023.SS1a

Title: _____

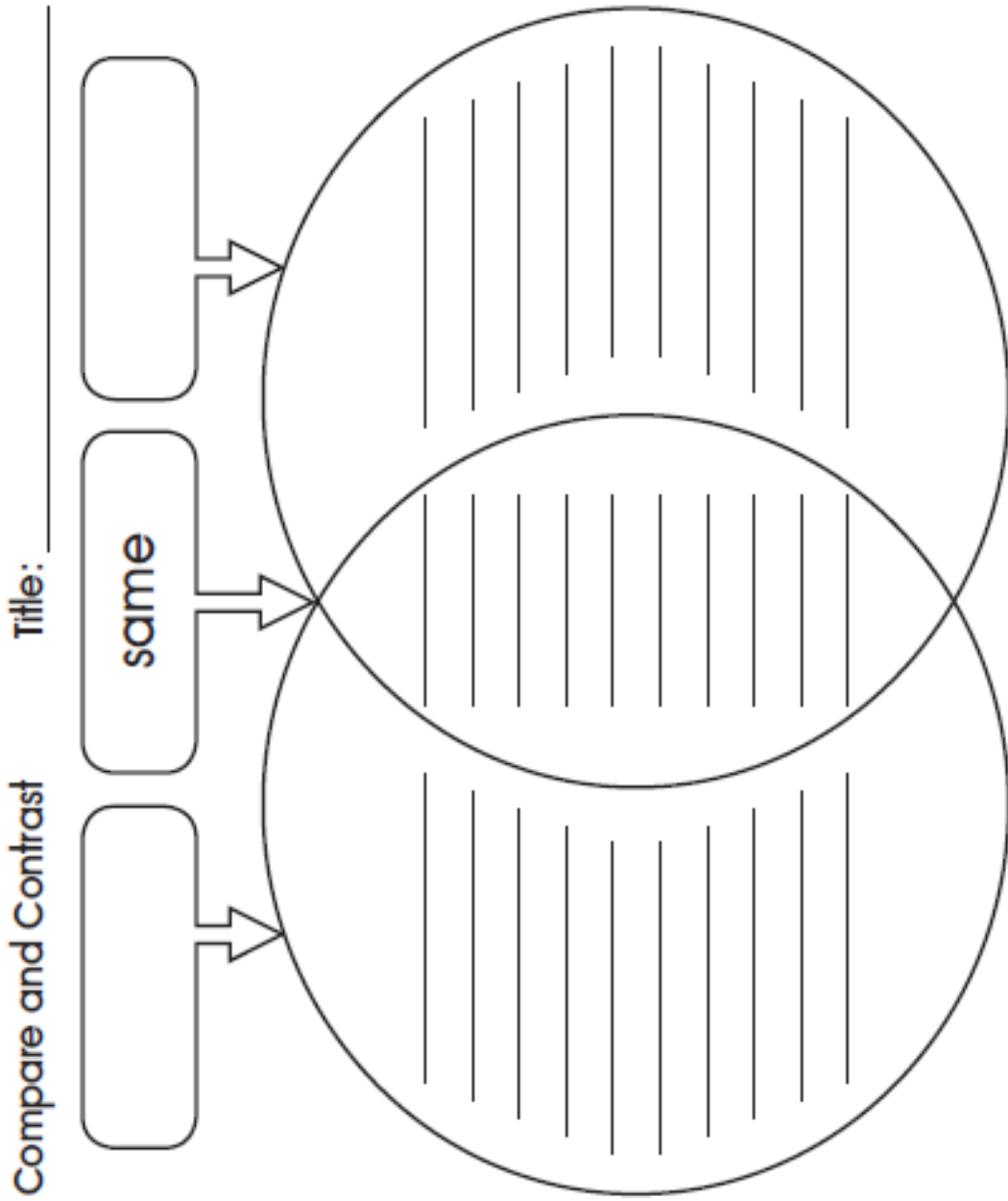
Cause and Effect



Name _____

C.023.SS1b

Text Structure Reflection



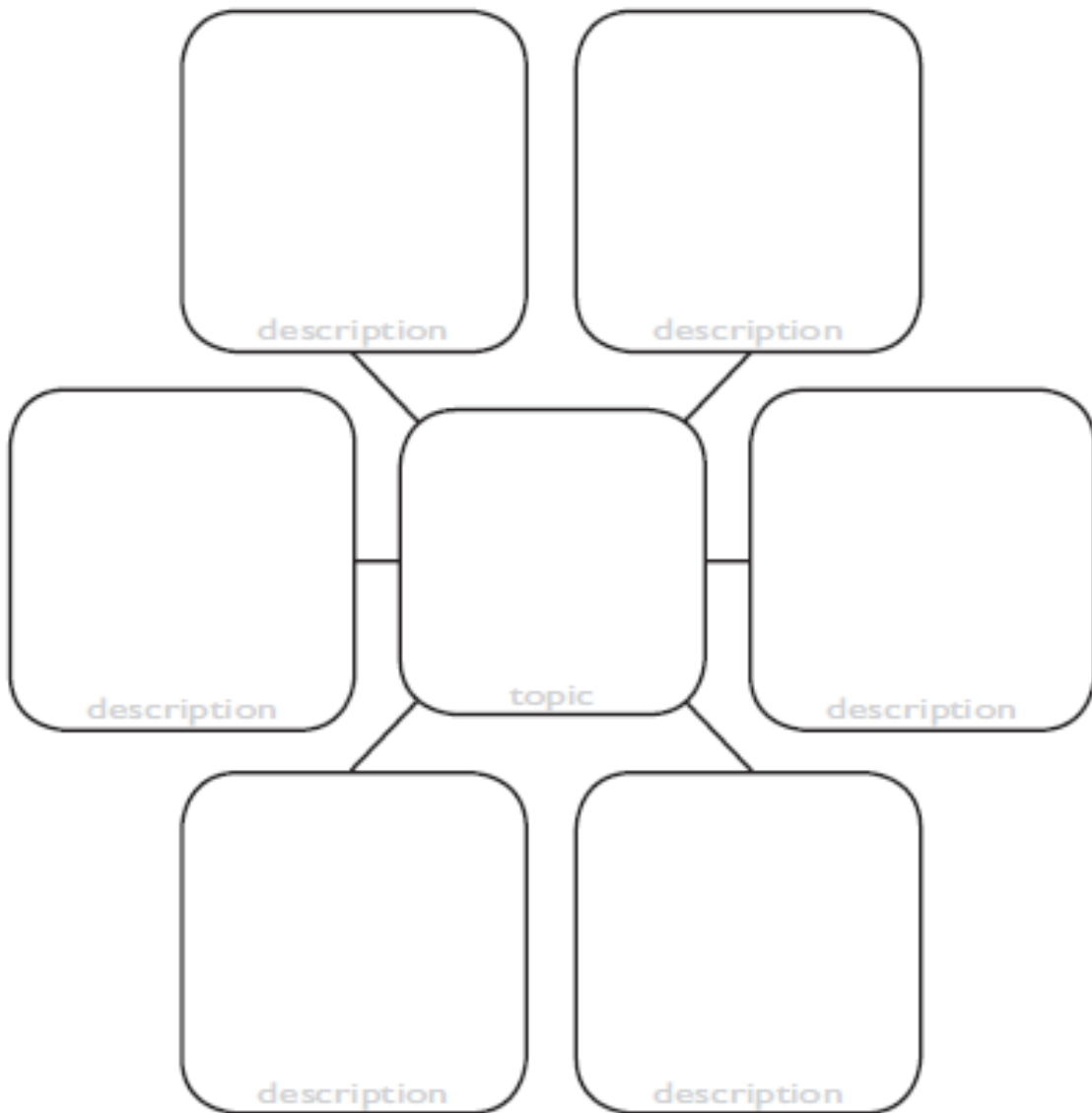
Name _____

Text Structure Reflection

C.023.SS1c

Title: _____

Description





You will learn:

- what causes the phases of the moon.
- how eclipses of the moon and sun occur.

Glossary

Glossary

satellite (sat'1 it), an object that revolves around another object

▲ For years people could only wonder about what the moon is like, but since astronauts traveled to the moon, many of the questions have been answered.

C102

Lesson 2

What Are the Effects of the Moon's Movement?

You have probably seen the moon many times. But it didn't always look the same! Why does the shape of the moon change? Does it really **shrink**—to a new moon? And **grow** to a full moon?

Phases of the Moon

Walk outside on a night when a full moon is shining and you will see how bright the moon seems. You would never guess that the moon does not make light. The moon only reflects light from the sun.

Look at the picture of Earth and the moon on the next page. You can see that the moon revolves around Earth. Since a **satellite** is an object that revolves around another object, the moon is a satellite of Earth.

If you look at a basketball or any other ball, you only see half of the ball. The moon is shaped like a ball. When you look at the moon, you only see half of the moon. As the moon revolves around Earth, only half of the moon is lighted. You can only see the moon when at least part of the half facing Earth is lighted.

Even though the moon is shaped like a ball, it appears to change shape. Look at the picture at the top of the next page. It shows some of the different shapes, or phases, of the moon. The changes in the moon's phases take $29\frac{1}{2}$ days—the time it takes the moon to revolve once around Earth.

▲ Each night more and more of the part of the moon facing Earth is lighted until you see a full moon! Then more and more of the part of the moon facing Earth is dark, until you don't see the moon—the new-moon phase.

How the Moon's Phases Occur

Full Moon

During the full-moon phase, the entire half of the moon facing Earth is lighted. You see the moon as a full circle. Since the same side of the moon always faces Earth, you always see the same half of the moon.

Half Moon

During the half-moon phase, half of the part of the moon facing Earth is lighted. Half of the moon facing Earth is dark. You see the moon as a half circle. This phase is sometimes called the first quarter because you are really seeing one-half of the lighted half, or one-quarter of the whole moon.

Half Moon

As less and less of the half of the moon facing Earth is lighted, you again see a half moon. This phase of the moon is sometimes called the last quarter. You are seeing half of the lighted half, or one-quarter of the whole moon.

New Moon

The entire half of the moon facing Earth is dark during the new-moon phase. You cannot see the moon in the sky. This phase occurs about two weeks after a full moon. The moon is now beginning a new set of phases.

Eclipses of the Moon and Sun

What happens if you hold a ball in front of a flashlight that is shining on a wall? You will see a shadow of all or part of the ball on the wall. Look at the pictures on these two pages to see what happens when Earth comes between the moon and the sun. Also, see what happens when the moon comes between the sun and Earth.

Lunar Eclipse

When the moon moves through the shadow of Earth, a **lunar eclipse** happens. Sometimes the moon is fully covered by Earth's shadow. This causes a total lunar eclipse. At other times only part of the moon is covered—a partial eclipse. ▼

Solar Eclipse

▲ When the moon makes a shadow on Earth, a **solar eclipse** happens. Sometimes the moon blocks all the sunlight from certain places on Earth. People in these places see a total solar eclipse. Other places see a partial eclipse.

C104

▲ These pictures were taken at different times during a lunar eclipse. They show the moon moving out of Earth's shadow.

◀ A solar eclipse is always a tempting view, but you should never look directly at the sun. Use a pin-point camera to make a shadow of the eclipse on a sheet of paper. It's the only safe way to view an eclipse of the sun.

Check Your Understanding

1. What causes the phases of the moon?
2. What causes a lunar eclipse and a solar eclipse?
3. **Main Idea**
What is the main idea of the text about a solar eclipse on this page?

It's time to... **PLAN!**

PREDICT

- Guess the text structure of the reading passage
- Create an appropriate map for the information
- Use the chapter headings, subheadings, and vocabulary to help you organize information

LOCATE

- Place a checkmark by familiar ideas
- Place a question mark by unfamiliar ideas

ADD

- Add information from the text to your map
- Eliminate map areas that are unimportant
- Use fix-up strategies to help fill out difficult map areas

NOTE

- Think about what you've learned
- Redo map if you guessed the wrong text structure
- Write your reflection on what you have learned



You will learn:

- how Earth is similar to and different from other planets.
- what the orbits of the planets are like.
- what scientists have learned about Earth's neighboring planets.

Glossary

Glossary

solar system
(sɒ'lər sis'təm), the sun, the nine planets and their moons, and other objects that orbit the sun

Earth

Earth takes one year to revolve around the sun. It takes one day to rotate once on its axis. Earth is the middle planet in size. Four of the nine planets are larger and four are smaller. Earth has one moon. ▼

Lesson 3

How Does Earth Compare with Other Planets?

Oooh! Earth, the beautiful blue planet! Do you know why it is so blue? Water makes it blue. And water is what makes Earth so different from all the other planets. Water gives life to Earth!

Comparing Earth to Other Planets



Earth is the only known planet that has air for you to breathe! Earth also has water for you to drink. Earth has all the resources that you and other living things need. From what we know today, Earth is the only planet in our solar system that can support the kind of life found on Earth!

Earth and the other planets are alike in one way. They are all satellites of the sun. The nine planets, their moons, and the sun make up most of our **solar system**. The planets can be seen in the sky as points of light that move among the stars. The planets seem to rise and set the way our moon does. Like Earth and its moon, the other planets do not make light. They reflect light from the sun.

Compare the pictures of the planets on the next page to the picture of Earth. Also, compare the length of days and years to those on Earth. The length of days and years are given in Earth time. A planet's day is the time it takes to rotate once on its axis. A planet's year is the time it takes to revolve once around the sun.

Mercury

Mercury takes 88 days to revolve around the sun. It takes 59 days to rotate once.

Mercury is four-tenths the distance of Earth to the sun. Mercury is the second smallest planet. It is less than half the size of Earth. Mercury has no moons.

Venus

Venus takes 8 months to revolve around the sun. It takes 243 days to rotate once. Venus is about seven-tenths the distance of Earth to the sun. It is the fourth-smallest planet—almost the same size as Earth. Venus has no moons.

Mars

Mars takes 1.9 years to revolve around the sun. It takes 25 hours to rotate once. Mars is 1.5 times the distance of Earth to the sun. It is the third-smallest planet—about half the size of Earth. Mars has 2 moons.

Jupiter

Jupiter takes 12 years to revolve around the sun. It takes 10 hours to rotate once. Jupiter is 5.2 times the distance of Earth to the sun. It is the largest planet—more than 11 times the size of Earth. Jupiter has at least 16 moons.

Saturn

Saturn takes 29.5 years to revolve around the sun. It takes about 11 hours to rotate once. Saturn is 9.5 times the distance of Earth to the sun. It is the second-largest planet—more than 9 times the size of Earth. Saturn has at least 18 moons.

Uranus

Uranus takes 84 years to revolve around the sun. It takes 17 hours to rotate once. Uranus is 19.2 times the distance of Earth to the sun. It is the third-largest planet—more than 4 times the size of Earth. Uranus has 17 moons.

Neptune

Neptune takes 165 years to revolve around the sun. It takes a little more than 16 hours to rotate once. Neptune is 30 times the distance of Earth to the sun. It is the fourth-largest planet—almost 4 times the size of Earth. Neptune has 8 moons.

Pluto

Pluto takes 250 years to revolve around the sun. It takes 6 days to rotate once. Pluto is 40 times the distance of Earth to the sun. It is the smallest planet—smaller than Earth's moon. Earth is more than 5.5 times the size of Pluto. Pluto has 1 moon.

Glossary

ellipse (i lips'), the shape of a flattened circle

The planets that are farthest from the sun have longer years than those closer to the sun. They have longer orbits and have to travel farther in one revolution. ▼

Orbits of the Planets

Look at the picture of our solar system. What do you think keeps the planets moving around the sun? It's the pull of gravity between the sun and the planets! Even planets as far away from the sun as Neptune and Pluto are affected by the pull of gravity.

Notice the orbits of the planets nearest the sun. You can see that they are almost circles. The orbits of the planets are really **ellipses**, or circles that have been flattened a little. You can see that the farther planets are from the sun, the longer their orbits are. These planets take longer to make one revolution around the sun.

The planets that orbit nearest the sun are somewhat like Earth. Mercury, Venus, and Mars are made up mostly of solid rock. Jupiter, Saturn, Uranus, and Neptune are very different from Earth. The outer parts of these planets are made up mostly of gas. These planets may be solid in the center. Unlike its neighbors, Pluto is made up of rock and ice.

You probably think that Pluto is farthest from the sun. Most of the time you are right! However, sometimes Neptune is farther from the sun than Pluto. This is because at times Pluto's orbit crosses Neptune's orbit. Between 1979 and 1999, Neptune was farthest from the sun.

Earth's Neighboring Planets

History
of Science



Before the 1970s, people on Earth knew little about the planets—even those nearby. Mercury was especially hard to study because it is so close to the sun. Then in 1974, the spacecraft *Mariner 10* traveled to Mercury. It sent back pictures such as the one shown. *Mariner 10* photographed about half of the sunlit side of Mercury. The pictures showed that the surface of Mercury is similar to Earth's moon. However, we still know less about Mercury than any other planet except for Pluto.

Venus is covered by thick clouds of gas. These clouds kept scientists from seeing the surface of Venus. Then in 1978, the Venus orbiter *Pioneer* was able to take pictures of Venus, such as the one below. The pictures showed hilly plains, highlands, large volcanolike mountains, and flat lowlands. Venus was later studied by the *Magellan* spacecraft. *Magellan* was launched from the shuttle *Atlantis*. It reached Venus on August 10, 1990. *Magellan* found that the surface of Venus is mostly covered by rocks and ash from volcanoes. However, the surface did not show wind erosion.

▲ Out of the blazing sun into a deep freeze! That's what happens when you go from daytime to nighttime on Mercury.

Venus is sometimes thought of as Earth's twin because the two planets are about the same size. However, they certainly are not identical twins! With no water and unbearable heat, nothing but rocks can exist on Venus. ▼

▲ *Pathfinder is shown on the surface of Mars.*

Sojourner is the robot rover that explored the surface of Mars. ▶

For many years, some people on Earth have expected a visit from people on Mars. In 1975, *Vikings 1* and *2* were sent to search for evidence of life on Mars. These spacecraft did not find evidence of any form of life on Mars. However, tiny amounts of water vapor were found.

Twenty-one years later, *Pathfinder* landed on Mars. *Pathfinder*, shown in the picture above, studied Martian rocks and soil. Then in 1997 the *Global Surveyor* spacecraft was launched to Mars. It sent back pictures, such as the one below. In May 1998 a report was released with new findings. The new findings gave more evidence that Mars was once a warmer, wetter planet. What scientists have thought to be old river beds may have been filled with flowing water at one time!

The Global Surveyor sent back this picture of Mars's Olympus Mons, a volcano. Radio signals that return data for pictures such as this one can reach Earth in about 14 minutes. ▼

Lesson 3 Review

1. How is Earth similar to the other planets?
2. Describe the orbits of the planets.
3. What have space probes helped scientists learn about Mars?
4. **Main Idea**
What is the main idea of the first paragraph on this page?

Lesson 4 Expository Passage



You will learn:

- what scientists have learned about Jupiter.
- what scientists have learned about Saturn and Uranus.
- what scientists have learned about Neptune and Pluto.

Jupiter's Great Red Spot is really a huge storm that has lasted over 100 years—maybe as long as 300 years. That's a king-sized storm! ▼

Lesson 4

What Have Scientists Learned About Distant Planets?

"Are we there yet?" How many times have you asked that question when going somewhere? You wouldn't be a good traveler on a space probe. Some probes take up to six years to arrive at the planet they are launched to!

Jupiter

History of Science



In 1972 scientists began sending spacecraft to explore Jupiter. *Pioneers 10* and *11* sent back information about Jupiter's magnetic field and polar regions. Then in 1977 the two *Voyager* spacecraft were launched. *Voyager 1* sent back many pictures, such as the one of Jupiter's Great Red Spot shown here.

The most recent mission to Jupiter was *Galileo*. The *Galileo* mission was really two spacecraft—an orbiter and a probe. When *Galileo* was built it was covered with black and gold material. The material was designed to protect the spacecraft from the heat of the sun and from the cold of space. Before being launched, the *Galileo* orbiter was tested in a chamber. The chamber provided the same conditions as those *Galileo* would find in space.

In 1989 *Galileo* was launched from the shuttle *Atlantis*. A rocket carried *Galileo* out of Earth's orbit. It may seem strange, but *Galileo* first traveled toward the sun. *Galileo* went zooming through the inner solar system—nearest the sun. Then with a gravity assist from Venus, *Galileo* traveled back near Earth. However, *Galileo* moved past Earth, went out into the solar system, and circled back toward Venus. *Galileo* repeated this journey twice—two years apart.

After these two years, *Galileo* had gained enough speed to send it on its way to Jupiter. Then scientists had to wait and wait. *Galileo* still had about four years to travel! Finally, on July 13, 1995, the orbiter released the probe. About five months later, the probe entered the atmosphere of Jupiter. At last, scientists could have some questions answered. The orbiter continued to study Jupiter and send back pictures, such as the ones below of Jupiter's moons.

Scientists learned that there is far less water in Jupiter's atmosphere than they expected to find. They learned that wind speeds on Jupiter are about four times as great as most hurricanes on Earth. Lightning on Jupiter is about ten times stronger than lightning on Earth. Jupiter sure doesn't sound like a very pleasant place to be!

▲ This is an artist's painting of *Galileo*.

Jupiter's moons not only differ in size but in makeup—from fiery volcanoes to plains of ice. With 16 moons, a moonlit night on Jupiter should be very bright! ▼

Io

Europa

Callisto

Ganymede

C119

Saturn and Uranus

In the early 1980s, the *Voyager* missions discovered that the particles in Saturn's rings vary in size. They range from dust particles to boulders, some the size of a house. Scientists think that Saturn's rings formed from larger moons that were hit by space objects and broken up. Notice the picture of Saturn and its rings near the top of the page.

▲ This picture was taken by *Voyager*. Before the *Voyager* missions, the only pictures we had of Saturn were artists' drawings.

Voyager also discovered 6 new moons orbiting Saturn. Six other objects were discovered later. At least one of those is a moon—making a total of 18. The moons have irregular shapes that seem to be pieces of larger bodies. The sizes of Saturn's moons range from the tiny Phoebe to Titan—the size of some planets.

A *Voyager* mission also flew by Uranus. *Voyager* proved that Uranus has a magnetic field around it. *Voyager* also found 10 new moons orbiting Uranus, and 2 more moons were discovered later—making a total of 17. Most of the new moons are small. Unlike the rings of Jupiter and Saturn, the rings of Uranus did not form at the same time as the planet. Compare the picture of the rings of Uranus to those of Saturn.

This picture of the rings of Uranus was taken by *Voyager 2*. ►

C116

Neptune and Pluto

Before *Voyager*, scientists thought that Neptune had only 2 moons, but *Voyager* discovered 6 more moons. Neptune's day was believed to have been 18 hours, but *Voyager* discovered that it is just over 16 hours. Another discovery was several large, dark spots similar to Jupiter's Great Red Spot. Find these spots in the pictures of Neptune. Even though Neptune's rings seem to be incomplete, *Voyager* found that they are complete. They seem incomplete because the materials in them are so tiny.

Pluto is the only planet that has not been visited by a spacecraft. However, the Hubble Space Telescope has taken pictures of Pluto, such as the one shown. Students working on some Pluto projects have built four full-sized spacecraft models. Maybe someday one of these models will be used to build a Pluto spacecraft.

▲ *The hurricane-like winds that blow around the dark spots on Neptune are stronger than the winds on any other planet. If you tried to walk on Neptune, you would be blown away!*

Lesson Review

1. What are two things that scientists learned about Jupiter from the *Galileo* mission?
2. What did the *Voyager* missions reveal about Saturn's rings?
3. Why do the rings of Neptune seem to be incomplete?
4. **Logical Reasoning**
Use the information in the first paragraph on this page to solve the following problem: How many moons does Neptune have?

The Hubble image of Pluto shows 12 large areas of light and dark features, but not much else. So Pluto still remains one of the mysteries of our solar system! ▼



What Other Objects Are Seen in the Solar System?

Please answer the following questions.

1. What is an asteroid?

2. What is a meteor?

3. What is a meteorite?

4. What is a comet?

5. How is the orbit of a comet different from the orbit of a planet?

6. What do stars, like the sun, make on their own?

7. Why do stars appear to rise and set even though they are not moving?

8. What is a group of stars that form a pattern in the sky called?

Lesson 5 Expository Passage



You will learn:

- what asteroids and meteors are.
- how the orbits of comets differ from those of planets.
- how the stars are like our sun.

Lesson 5

What Other Objects Are Seen in the Solar System?

If you look at the sky during the day, you may see the sun, clouds, or the moon—an airplane or a bird. At night, the planets move among billions of **twinkling** stars. You may also see the moon or a comet.

Glossary

Glossary

asteroid (as'ta roid'), a rocky object orbiting the sun between the planets

meteor (mē'tē ar), piece of rock or dust from space burning up in Earth's air

meteorite (mē'tē a rit'), a rock from space that has passed through Earth's air and landed on the ground

This is a crater made by a meteorite that hit Earth in Arizona. ▼

Asteroids and Meteors

Thousands of objects orbit the sun, mostly between the orbits of Mars and Jupiter. These objects are made of rock and are known as **asteroids**. Some of them are shaped like planets, but others are more oval or have irregular shapes. The largest asteroid, Ceres, is about the same size across as the state of Texas. Some asteroids have satellites of their own.

Besides asteroids, other smaller pieces of dust and rock orbit the sun. Sometimes one of these small pieces comes close enough to Earth to be pulled into Earth's air. As the rock moves through the air, friction causes the rock to heat up and burn. Then the rock or dust is called a **meteor**. Have you ever seen a "shooting star" at night? These flashes of light in the sky are meteors. Sometimes a meteor is so large that all of it does not burn up before reaching Earth. A meteor or part of a meteor that reaches the ground is a **meteorite**. Some meteorites hit Earth hard enough to make deep holes, or craters, in Earth's surface. Notice the size of the meteorite crater in the picture.

Comets

In 1994 comet Shoemaker-Levy 9 broke up near Jupiter. A comet is a large chunk of ice and dust that orbits the sun. A piece of the comet is shown hitting the surface of Jupiter in the picture below.

In 1997 many people were excited about the comet Hale-Bopp. Hale-Bopp, shown in the picture, was one of the brightest comets to pass near the sun in history. It came closest to Earth on March 27, 1997. Scientists think that Hale-Bopp passed by the sun about 4,200 years ago. Can you imagine how long its orbit must be?

Comets have orbits that are much longer and flatter than the orbits of planets. During most of its orbit, a comet is far away from the sun. When they are far away, comets can't be seen from Earth. At that time, they also do not get much heat from the sun. As a comet moves closer to the sun, the sun's energy begins to heat the comet. Some of the ice becomes a gas. Then the gas and dust are pushed into a long tail. The tail extends from the bright part of the comet known as the head. The tail of a comet may be millions of kilometers long.

The dark spots show where pieces of Shoemaker-Levy 9 hit the surface of Jupiter. ▶

More than 20 pieces of comet Shoemaker-Levy 9 hit the surface of Jupiter in 1994. The Galileo spacecraft recorded this event. What a fiery display! ▶

Glossary

comet (kom'it), a frozen chunk of ice and dust that orbits the sun

▲ Comet Hale-Bopp was one of the brightest objects in the night sky between mid-March and early May of 1997. More people may have seen this comet than any other.

Glossary**constellation**

(kon'stə lā shən), a group of stars that form a pattern

▲ *The sun is the largest, brightest, and hottest object in our solar system. It has more mass than all the other objects in our solar system put together.*

Telescopes magnify distant objects in the sky. The girl can see many more stars with the telescope than with the unaided eye. ►

Stars

The girl in the picture is using a telescope to study the stars. Just think—millions of “suns” twinkling in the sky! Yes, that’s right, the stars in the picture on the next page are just like our sun in the picture on the left. They make their own light. In fact, our sun is just an average-sized star. It seems so large because it is so much closer than any of the other stars. The sun provides all the energy for life on Earth. The sun’s energy heats and lights Earth.

Earth’s rotation makes the sun appear to rise in the east and set in the west. The other stars also appear to rise and set slowly throughout the night. Earth’s rotation makes the stars appear to circle Polaris, the North Star. However, like our sun, the other stars stay in the same place.

When you look at the stars, you may sometimes see groups of stars that seem to form a pattern. Throughout all of history, people have been watching these star patterns, or constellations. A group of stars that forms a pattern in the night sky is a **constellation**. Different cultures have named these star patterns.

You may have noticed the seven stars in the sky that make up the Big Dipper. These seven stars are part of the constellation called Ursa Major, or Big Bear. The two end stars of the dipper's bowl can help you locate Polaris—or the North Star. The North Star was important to early travelers, because it helped them find their way.

▲ We see billions of stars, but they are not in our solar system. They are much farther away than our sun. Half of these stars may be bigger and brighter than our sun!



1. How are asteroids and meteors alike?
2. How are the orbits of comets different from those of the planets?
3. How are other stars like our sun?

4. Main Idea

What is the main idea of the first paragraph on page C120?

5. How is the orbit of a comet different from the orbit of a planet?

6. What do stars, like the sun, make on their own?

7. Why do stars appear to rise and set even though they are not moving?

8. What is a group of stars that form a pattern in the sky called?

On the following page, create a visual image that shows the difference between a meteor and a meteorite.

Appendix T

Lesson 1 Free-Response Question Rubric

Question 1	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • axis • imaginary • line/pole • passes through Earth 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • axis • imaginary • line/pole • passes through Earth 	3 points Answer addresses three of the following: <ul style="list-style-type: none"> • axis • imaginary • line/pole • passes through Earth 	4 points Answer addresses all of the following: <ul style="list-style-type: none"> • axis • imaginary • line/pole • passes through Earth
Question 2	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • 24 hours • one day 	2 points Answer addresses all of the following: <ul style="list-style-type: none"> • 24 hours • one day 		
Question 3	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • facing toward/away from the sun • movement of sun/time • day/night 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • facing toward/away from the sun • movement of sun/time • day/night 	3 points Answer addresses all of the following: <ul style="list-style-type: none"> • facing toward/away from the sun • movement of sun/time • day/night 	
Question 4	0 points Does not provide any relevant information	1 point Answer addresses the following: <ul style="list-style-type: none"> • orbit 			
Question 5	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • 365 days • one year 	2 points Answer addresses all of the following: <ul style="list-style-type: none"> • 365 days • one year 		
Question 6	0 points Does not provide any relevant information	1 point Answer addresses the following: <ul style="list-style-type: none"> • gravity 			
Question 7	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • direct/indirect sunlight • more/less heat • seasons 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • direct/indirect sunlight • more/less heat • seasons 	3 points Answer addresses all of the following: <ul style="list-style-type: none"> • direct/indirect sunlight • more/less heat • seasons 	
Question 8	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • same amount of sun • equator hotter • north and south cooler • no seasons 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • same amount of sun • equator hotter • north and south cooler • no seasons 	3 points Answer addresses three of the following: <ul style="list-style-type: none"> • same amount of sun • equator hotter • north and south cooler • no seasons 	4 points Answer addresses all of the following: <ul style="list-style-type: none"> • same amount of sun • equator hotter • north and south cooler • no seasons

Appendix U

Lesson 5 Free-Response Question Rubric

Question 1	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space 	3 points Answer addresses three of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space 	4 points Answer addresses four of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space 	5 points Answer addresses five of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space 	6 points Answer addresses all of the following: <ul style="list-style-type: none"> • large • rock • planet/ova/irregular shape • orbits sun • between planets • in space
Question 2	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • rock or dust • orbits sun • Earth's pull • burns up • shooting star 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • rock or dust • orbits sun • Earth's pull • burns up • shooting star 	3 points Answer addresses three of the following: <ul style="list-style-type: none"> • rock or dust • orbits sun • Earth's pull • burns up • shooting star 	4 points Answer addresses four of the following: <ul style="list-style-type: none"> • rock or dust • orbits sun • Earth's pull • burns up • shooting star 	5 points Answer addresses all of the following: <ul style="list-style-type: none"> • rock or dust • orbits sun • Earth's pull • burns up • shooting star 	
Question 3	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • rock • meteor/part of meteor • hits Earth 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • rock • meteor/part of meteor • hits Earth 	3 points Answer addresses all of the following: <ul style="list-style-type: none"> • rock • meteor/part of meteor • hits Earth 			
Question 4	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • large • ice/dust • orbits sun • gas tail • bright head 	2 points Answer addresses two of the following: <ul style="list-style-type: none"> • large • ice/dust • orbits sun • gas tail • bright head 	3 points Answer addresses three of the following: <ul style="list-style-type: none"> • large • ice/dust • orbits sun • gas tail • bright head 	4 points Answer addresses four of the following: <ul style="list-style-type: none"> • large • ice/dust • orbits sun • gas tail • bright head 	5 points Answer addresses all of the following: <ul style="list-style-type: none"> • large • ice/dust • orbits sun • gas tail • bright head 	
Question 5	0 points Does not provide any relevant information	1 point Answer addresses one of the following: <ul style="list-style-type: none"> • longer • flatter 	2 points Answer addresses all of the following: <ul style="list-style-type: none"> • longer • flatter 				
Question 6	0 points Does not provide any relevant information	1 point Answer addresses the following: <ul style="list-style-type: none"> • light 					
Question 7	0 points Does not provide any relevant information	1 point Answer addresses the following: <ul style="list-style-type: none"> • Earth's movement/rotation 					
Question 8	0 points Does not provide any relevant information	1 point Answer addresses the following: <ul style="list-style-type: none"> • constellation 					

Appendix V

Design/Text Feature Element Definitions

Design/Text Feature Element	Definition
Caption	A sentence or sentence fragment that provides a description of an image
Label	A word(s) that names what an object is composed of, a part of the object, or what the object is
Heading	A word(s) that names the theme or topic of the following information
Rule	A line drawn across or down a page that links or separates items
Box	A frame drawn around information to isolate it
Arrow/Line	A symbol used to link labels to what they are describing or show a sequence of items

Appendix W

Actual Instructional Time Table

PHASE 1				
Day 1	Day 2	Day 3	Day 4	Day 5
<ul style="list-style-type: none"> Promethean text features introduction 	<ul style="list-style-type: none"> Reading textbook text features activity 	<ul style="list-style-type: none"> Science textbook text features activity 	<ul style="list-style-type: none"> Scholastic News text features activity 	<ul style="list-style-type: none"> Kagan Quiz, Quiz, Trade Promethean text features quiz
PHASE 2		PHASE 3		
Day 6	Day 7	Day 8	Day 9	Day 10
<ul style="list-style-type: none"> Pretest lesson 1: <i>Movements of the Solar System</i> 	<ul style="list-style-type: none"> Read lesson 1 Posttest lesson 1 	<ul style="list-style-type: none"> Read <i>Dear Mr. President</i> (cause and effect) Complete graphic organizer 	<ul style="list-style-type: none"> Read <i>Colonial Life versus Life Today</i> (compare and contrast) Complete graphic organizer 	<ul style="list-style-type: none"> Read <i>Lucky Shot!</i> (description) Complete graphic organizer
PHASE 4				
Day 11	Day 12	Day 13	Day 14	Day 15
<ul style="list-style-type: none"> Introduce PLAN 	<ul style="list-style-type: none"> Read lesson 2: <i>What Are the Effects of the Moon's Movement?</i> Begin PLAN with whole class 	<ul style="list-style-type: none"> Complete PLAN for lesson 2 	<ul style="list-style-type: none"> Read lesson 3: <i>How Does Earth Compare with Other Planets?</i> Begin PLAN with partners 	<ul style="list-style-type: none"> Continue PLAN for lesson 3
PHASE 4			PHASE 5	
Day 16	Day 17	Day 18	Day 19	Day 20
<ul style="list-style-type: none"> Complete PLAN for lesson 3 	<ul style="list-style-type: none"> Read lesson 4: <i>What Have Scientists Learned About Distant Planets?</i> Begin PLAN individually 	<ul style="list-style-type: none"> Continue PLAN for lesson 4 	<ul style="list-style-type: none"> Complete PLAN for lesson 4 	<ul style="list-style-type: none"> Pretest lesson 5: <i>What Other Objects Are Seen in the Solar System?</i>
PHASE 5				
Day 21	Day 22	Day 23	Day 24	
<ul style="list-style-type: none"> Read lesson 5 Begin PLAN individually 	<ul style="list-style-type: none"> Continue PLAN for lesson 5 	<ul style="list-style-type: none"> Complete PLAN for lesson 5 	<ul style="list-style-type: none"> Posttest lesson 5 	