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ENHANCING STUDENTS' SCIENCE CONTENT KNOWLEDGE THROUGH TEXT STRUCTURE AWARENESS

by

Jamie Lynn Christensen

A thesis submitted to the faculty of

Brigham Young University

In partial fulfillment of the requirements for the degree of

Master of Arts

Department of Teacher Education

Brigham Young University

June 2008

BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the thesis of Jamie Christensen in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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ABSTRACT

ENHANCING STUDENTS' SCIENCE CONTENT KNOWLEDGE THROUGH TEXT STRUCTURE AWARENESS

Jamie Lynn Christensen

Department of Teacher Education

Master of Education

The purpose of this study was to examine the effects of teaching text structure as a tool to assist first grade students' understanding of science content in a unit of study on plants. A quantitative analysis was performed to reveal any difference in mean post-test scores between a control group and a treatment group. Results indicated that the treatment group students' science content knowledge was increased significantly more than students in the control group. Usage of specific text structure keywords did not increase. However, students did use synonyms of keywords. Recommendations for further research are discussed.

ACKNOWLEDGEMENTS

I would like to thank my committee chair, Pamela Cantrell, for all the time she has spent reading and editing my drafts and for her encouragement. I would also like to thank my other committee members, Kendra Hall and Leigh Smith, for their insights and support.

A big thanks goes to the first grade teachers and students who participated in this project, whose help made this research possible.

Finally, I express appreciation to my wonderful husband, Bryce, and to my family for their endless support and prayers throughout this project.

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CHAPTER 1

Introduction

The central goal of science education today is aimed at enabling all children to learn and do science (American Association for the Advancement of Science [AAAS], 1990, 1993; National Research Council [NRC], 1996). This vast undertaking requires that children have opportunities to learn science in the most effective ways possible (Ginsberg & Golbeck, 2004; Hadzigeorgiou, 2001; Horowitz et al., 2005; National Association for the Education of Young Children [NAEYC], 1997, Yoon & Onchwari, 2006). Recently, many researchers and authors have asserted that effective science learning includes literacy as an integral and constitutive part of science. Through using literacy in science, students may enhance their knowledge of science content and have greater access to learning (Norris & Phillips, 2003; NRC, 1996; Osborne, 2002).

Elements of How Young Children Learn Science

This study explored how to help young children learn science using researched based methods. Much is now known about how to help children know and *do* science (NRC, 1996). Connecting science experiences to real life, doing science within a social context, providing opportunities for children to inquire, using developmentally appropriate activities, and making science enjoyable (Ginsberg & Golbeck, 2004; Hadzigeorgiou, 2001; Lind, 1997; Yoon & Onchwari, 2006) are just a few of the important considerations that must be addressed when planning science experiences for young children. These considerations will be discussed in more detail in Chapter Two.

Several national organizations strongly advocate that all children can learn science (AAAS, 1990, 1993; NRC, 1996). In fact, helping all children learn science has been an important focus of current science reform movements since 1989 when *Project 2061*, the approach advocated by the AAAS, was established (NAEYC, 2002). The *National Science Education Standards (NSES)* also state that regardless of age, background, ability, and interest, all students can learn science (NRC, 1996).

Scientific Literacy

With the call for all children to learn and do science, the term *scientific literacy* has become a focal point of helping children achieve this goal. Scientific literacy for all Americans has become an overarching goal in science education. This goal includes increasing the science knowledge of the general population to the extent that all may responsibly participate and contribute to addressing societal problems. This goal also specifies that K-12 students will be scientifically literate by the end of their public school experience. Several national organizations and researchers have proposed that young children can begin working towards scientific literacy at an early age (AAAS, 1990, 1993; Lind, 1996; Moss, 2005; NAEYC, 1997; NRC, 1996).

While educators and researchers have generally been united in their belief that the country needs a scientifically literate citizenry, discrepancies over the definition of scientifically literate have emerged. Some researchers view scientific literacy as having deep content area knowledge in a scientific field (DeBoer, 2000). However, others view scientific literacy as having a science knowledge base broad enough, but not necessarily deep, to responsibly solve real life problems (AAAS, 1990; Hand, Prain, & Yore, 2001; Hurd, 1998).

Science For All Americans: Project 2061 (AAAS, 1990) identifies specific science goals all students should achieve to become scientifically literate:

> Science education should help students to develop the understandings and habits of mind they need to become compassionate human beings able to think for themselves and to face life head on. It should equip them also to participate thoughtfully with fellow citizens in building and protecting a society that is open, decent, and vital. (p. v)

The report also states that a scientifically literate person understands concepts and principles of science and applies scientific knowledge and thinking to real life. This definition of scientific literacy fits within what Norris and Phillips (2003) call the *derived sense* of scientific literacy or "being knowledgeable, learned, and educated in science" (p. 224).

Literacy Components of Scientific Literacy

Some authors include a literacy component in their definition of scientific literacy (Norris & Phillips, 2003; Yore, Bisanz, & Hand, 2003). Norris and Phillips (2003), identify the ability to communicate (read, write, speak, listen) about and in science as the *fundamental sense* of scientific literacy. Other researchers argue that literacy skills such as talking, thinking, recording, and predicting play critical roles in scientific inquiry, and that scientists use literacy tools such as reading and writing to accomplish their work (Anderson, 1999; Gelman & Brenneman, 2004). In fact, literacy has been viewed as necessary to science as a sail is to a ship (Osborne 2002).

Text. Because literacy is viewed as an important component of science (Anderson, 1999), it is important to understand how various texts are used to make meaning in science. While some authors view text strictly from a print-based perspective, others argue that text includes a broad spectrum of ways of communicating and understanding (Draper, Smith, Hall, & Siebert, 2005). Rafferty (1999) for example, explains an expansive view of text that can include many mediums such as: "print, visual, video, audio, or electronic" (p. 23). In this study, text included writings, speeches, drawings, matrices, and printed text.

As students use the literacy skills of reading, writing, speaking, and listening, they must have a text to read, write, speak, or hear. Access to scientific knowledge comes through text (Norris & Phillips, 2003). The *NSES* (NRC, 1996) call for students to use these types of literacy skills to construct scientific knowledge. Students must ask questions, infer meaning, discuss ideas with peers and adults, create and share explanations, and communicate these ideas to others.

Text structure. While text structure generally refers to "the semantic and syntactic organizational arrangements used to present written information" (Educational Development Center, 2003), this study expanded text structure to include the organizational arrangements used to present written, verbal, and graphed information. Various types of text, whether written, verbal, or graphed, have a structure in how they are put together. The way a text is structured helps a person understand relationships among ideas. There are various types of text structures. Some of these include description, time sequence, cause and effect, listing, compare/contrast, and problem and solution (Tompkins, 2003).

Williams, Hall, and Lauer (2004) suggest that being aware of how a text is organized helps students better understand content-specific information. They explain that "this structural information is important because it helps readers organize the content and thus aids in the process of constructing the mental representation, that is, the meaning of the text" (p. 130). Text structure awareness can also increase students' reading comprehension (Williams et al., 2004).

In the present study, children were explicitly taught compare/contrast text structures to support science content learning. This type of structure compares how two things are alike and/or how they are different. One aid often used to help students understand a compare/contrast text structure is a matrix. A matrix is a graphic organizer that can be used to represent compare/contrast text structure (Smith, Draper, & Hall, 2005). Text structures are described in more detail in Chapter Two.

Links Between Science and Literacy

Science, literacy skills, and text are integrally connected and people use these to create and share new scientific knowledge. Literacy skills are necessary to communicate scientific ideas through writing, speech, diagrams, maps, or graphs, and are the means through which science meaning is made and understood. Hand, Prain, Lawrence, and Yore (1999) suggest that students' science content knowledge may be strengthened as students integrate writing in science. Gee (2001) proposed that "reading and writing cannot be separated from speaking, listening, and interacting, on the one hand, or using language to think about and act on the world, on the other" (p. 714). Communication through literacy is also the way that the public accesses scientific knowledge and makes decisions affecting society. Thus, literacy and science are linked in the process of learning and understanding (Norris & Phillips, 2003; NRC, 1996).

Statement of the Problem

While scientific literacy is the current overarching goal of science education in the United States (NRC, 1996), the literacy component is often left out of science lessons. Scientific literacy needs to involve the literacy component as well as the science content component to help students become scientifically literate (Anderson, 1999; Osborne, 2002; Yore et al., 2003). Several studies have been conducted on teaching or evaluating text structure using science content for the purpose of increasing students' comprehension of print-based text (Hall, Sabey, & McClellan, 2005; McGee, 1982; Williams et al., 2004; Williams, Hall, Lauer, Stafford, & DeSisto, 2005). However, this study fills a gap in the literature as it focused on teaching compare/contrast text structure as a tool to assist students' understanding of science content.

Purpose of the Research

Literacy studies have been conducted on teaching children text structures using science content in an effort to improve text comprehension (Hall et al. 2005; Williams et al., 2004). However, the purpose of this research was to investigate the effects of teaching science content integrated with text structure awareness on first grade student science content knowledge.

Research Questions:

The questions that guided this research were

1. Will first grade students in classrooms where text structure is integrated with science instruction perform better on interview examination than their peers who do not receive the integrated instruction?

2. Will first grade students in classrooms where text structure is integrated with science instruction perform better on explaining science concepts using text structure keywords than their peers who do not receive the integrated instruction?

CHAPTER 2

Review Of Literature

This study investigated the effects of the integration of text structure awareness and science content instruction on students' understanding of science content in an instructional unit on plants. Literature pertinent to how young children learn science will be discussed first, followed by a section on scientific literacy. Discussions on text and text structures will follow, concluding with a discussion of the complementary nature of science and literacy.

Elements of How Young Children Learn Science

For science learning to take place, teachers must create classrooms where children can learn science in effective ways (Bransford & Donovan, 2005; Magnusson & Palincsar, 2005; Minstrell & Kraus, 2005). "Effective teachers are able to figure out not only what they want to teach, but also how to do so in a way that students can understand and use the new information and skills" (Horowitz et al., 2005, p. 88). While science is often taught in isolation from children's everyday world (Alvermann & Moore 1991; Ginsburg & Golbeck, 2004), some authors have recommended that children learn science best as they relate their everyday experiences to science concepts. Dewey (1916) cautioned against the separation of content from experience: "There is no such thing as an ability to see or hear or remember in general; there is only the ability to see or hear *something*" (p. 65, emphasis in original). To learn effectively, students must have science experiences that connect to their world and provide new insights into daily occurrences (Bransford & Donovan, 2005; Conezio & French, 2002). These types of real life science experiences generally include opportunities for children to act and experiment with concrete objects (Krogh, 1997). For example, science experiences that connect to a child's life may include observing objects as they sink or float in a bathtub, pouring water from a fat round container into a tall thin container, and eating an ice cream cone before it melts on a hot day.

Experiences connected to a child's life generally involve communication and discussion; thus, children can learn science effectively as science is placed in a social context. Through engaging in discussions with teachers and peers, children have opportunities to reflect on their findings, talk about how they reached their conclusions, share ideas, listen to others, challenge theories and compare their findings to previously held beliefs (AAAS, 1990; Conezio & French, 2002; Magnusson & Palincsar, 2005). Barclay, Benelli, and Schoon (1999) noted that "children often need to be encouraged, through questions, to think and talk about their experiences and explorations, and to describe them to others" (p.146). Thus, " . . . children's development unfolds in social contexts" (Bransford, Darling-Hammond, & LePage, 2005, p. 33). Discussion in a social context also provides opportunities for children to delve into scientific thinking and inquiry.

In the current reform movement, inquiry has become a topic of much focus and is described as critical to learning and doing science effectively. Inquiry includes questioning, observing, reasoning, thinking and imagining and is necessary for students to conceptually understand how to do science (Bransford & Donovan, 2005). The *NSES* (NRC, 1996) defines inquiry as

> A multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers,

> explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (p. 23)

The process of inquiry is valuable to children's understanding of science because it helps them solve their own queries using many of the same thinking skills and activities used by scientists to solve problems (Conezio & French, 2002; NRC, 1996).

Learning how to engage in scientific inquiry is a foundational skill for young science learners. Children in elementary school can successfully begin learning about scientific reasoning, measuring, observing and researching their own questions (Bransford & Donovan, 2005; Magnusson & Palincsar, 2005). Children need opportunities " . . . to develop possible theories about their own questions and then proceed to investigate these theories within the classroom learning community" (Conezio & French, 2002, p. 15). Understanding how to work through the process of inquiry lays a foundation for children to continue a pattern of developing scientific knowledge and understanding.

Along with inquiry, children must learn science in developmentally appropriate ways. Developmentally appropriate practice is based on knowledge about how children develop and learn (Horowitz et al., 2005). Science educators must understand the developmental changes that typically occur in the years from birth through age eight and beyond, variations in development that may occur, and how best to support childrens' learning development during these years. Science experiences must be structured to accommodate for the developmental stage and understanding of the children involved (Barclay et al., 1999; Bransford & Donovan, 2005; Hadzigeorgiou, 2001; Horowitz et al., 2005; Lind, 1997; Yoon & Onchwari, 2006).

Finally, to enable students to learn science in the best way possible, science learning must spring from childrens' curiosities. A focus on only learning scientific skills or memorizing facts and information may dry up curiosity, the very source of science (Bransford & Donovan, 2005; Hadzigeorgiou, 2001). Educators can capitalize on children's intrinsic interest of the world and how it works by offering opportunities for students to ask questions and actively participate in working towards solutions (Conezio & French, 2002; NAEYC, 1997). As children engage in science in developmentally appropriate ways, they are becoming scientifically literate.

Scientific Literacy

Some authors claim that "scientific literacy has become necessary for everyone" (AAAS, 1990, p. ix). Many challenges faced today are global problems such as: global warming, food shortages or famine, disease, ozone deterioration, and pollution hazards. Because solutions to these problems are rooted in science knowledge, it is incumbent upon *all* Americans to have an understanding of science to the extent that their knowledge may be applied to problems in appropriate and beneficial ways. Additionally, this scientific understanding should be developed by students during their public school experience and expand over a lifetime (AAAS, 1990; NRC, 1996).

While most science educators and researchers agree that scientific literacy is crucial for all students, definitions of scientific literacy differ. Some definitions of scientific literacy center on students gaining advanced content knowledge in various scientific fields (DeBoer, 2000). However, other definitions posit that scientific literacy deals with having a broad base of scientific knowledge and skills that enable humans to contribute to solving societal problems (Hand et al., 2001; NRC, 1996). An example of this broad type of thinking about scientific literacy can be found in the *National Science Education Standards* (NRC, 1996):

> Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed. A literate citizen should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately. (p. 22)

Literacy Components of Scientific Literacy

Other definitions of scientific literacy specifically focus on literacy, problem solving, and content in science. Norris and Phillips (2003) call reading and writing in science the *fundamental sense* of scientific literacy. They propose that science cannot be separated from literacy skills such as reading, writing, speaking, and listening, as these are "constitutive parts of science" (p. 226). The *fundamental sense* of scientific literacy requires that students not only decode what they read, but also read critically, make inferences that move beyond the text, and use their science knowledge to evaluate and critique. They state, "Interpretation of science text involves, to be sure, knowledge of substantive scientific content" (p. 235). Students must problem solve by grasping the meanings expressed beyond the surface content.

An example of the importance of *fundamental* literacy skills used in developing new scientific knowledge occurred during World War II when many scientists were sequestered at Los Alamos, NM. Richard Feynman, one of these scientists, shared how scientists communicated ideas and listened carefully to each other's comments while developing the scientific knowledge necessary to build the atomic bomb (Feynman, 1985). Anderson (1999) stated, "Reading and writing are the mechanisms through which scientists accomplish [their] task. Scientists create, share, and negotiate the meanings of inscriptions- notes, reports, tables, graphs, drawings, diagrams" (p. 973). Thus, reading, writing, speaking, and listening are necessary to *do* science (NRC, 1996).

Through the *fundamental sense* of scientific literacy, students may grapple with ideas, speak with peers and teachers, write and graph conclusions, and construct conceptual understanding. Through these literacy skills, students can build science knowledge and become educated in science content. Being knowledgeable in science and understanding scientific concepts is what Norris and Phillips (2003) call the *derived sense* of scientific literacy. Thus, the *fundamental sense* and the *derived sense* are both necessary in creating new scientific knowledge.

Norris and Phillips (2003) further argue that the purpose of literacy is to construct and interpret meaning from text, whether the text is written or verbal. Through the medium of text, students learn to read, and read to learn. Only through text do students develop understanding of science concepts.

Text. While text is often thought of as a print-based collection of words, other forms of text such as, speech, diagrams, maps, models, and graphs, are all considered types of text by some authors (Draper & Siebert, 2004; Draper et al., 2005; Freire, 1983; Gee, 2001; Norris & Philips, 2003; Rafferty, 1999). In this study, text is viewed from a broad perspective and includes print, images, graphs, conversations, etc. (Draper et al., 2005). Because this study involved first grade students, the primary text is not pre-constructed print. Rather, the students and teachers created text in the moment through writing, pictures, and conversation. This text was recorded in a written and pictorial format. These created texts were a representation of students' comprehension.

The meaning that a student gathers from text (print, conversation, pictures) is connected to his or her world experiences (Freire, 1983; Gee, 2001; Rafferty, 1999). "Reading the word and reading the world are, at a deep level, integrally connected—indeed, at a deep level, they are one and the same process" (Gee, 2001, p. 717). Paulo Freire stated that, "Reading the world precedes reading the word" (1983, p. 5). Gee (2001) discussed how a student's comprehension of texts relates to the *social discourses* he or she knows, or the representations of meanings he has created from his worlds of home, school, etc. He explains, "Any piece of language is treated as representation (p. 715). All of these representations of meaning contain a structural element that can be recognized and studied.

Text structure. Whether printed, spoken, or graphed, text has structure. This structure deals with the organizational arrangements of the text. While most information in text relates to content, some information is about structure. This structural information helps the reader negotiate the text, organize the content, and construct meaning (Williams, et al. 2004). A reader's lack of comprehension of text often indicates a lack of knowledge concerning text structure (Williams et al., 2004) or how the text is organized (Armbruster, Anderson, & Ostertag, 1987).

There are several types of text structures found in informational texts (Tompkins, 2003). Some of these include description, time sequence, cause and effect, listing, compare/contrast, and problem and solution (Smith et al., 2005). Description text structure is apparent when an author describes a topic by listing characteristics, features, and examples. In time sequence text structure the author lists items or events in numerical or chronological order. For cause and effect text structure, the author lists one or more causes and the resulting effect or effects. In listing text structure the author lists items or events in some order other than chronological. In a compare/contrast text structure the author explains how two or more things are alike and/or different. Finally, in a problem and solution text structure, the author states a problem and lists one or more solutions for the problem (Smith et al., 2005; Tompkins, 2003).

Becoming familiar with text structures requires that students interact with the various types in their reading (Duke, 2003). However, teachers should only teach one text structure at a time (Williams et al., 2004). A compare/contrast text structure was chosen for this study. A compare/contrast strategy involves describing how two or more things are different and/or alike. An example of a compare/contrast text structure is shown in Figure 1 (Tompkins, 2003. p. 303).

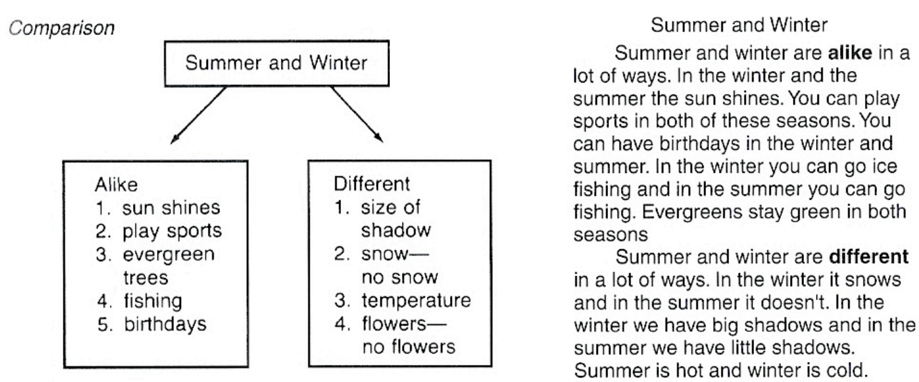

Figure 1. Compare/contrast text structure.

The type of graphic organizer that represents ideas apparent in the structure of the text that could be used with compare/contrast text structures is a matrix (Smith et al., 2005). An example of a compare/contrast matrix is shown in Figure 2 (Hall et al., 2005, p. 220).

Animal Matrix
Finding out how animals are the same and different

Animal	Is the animal warm-blooded or cold-blooded?	
	Warm-blooded	Cold-blooded
Lion	X	
Snakes		X

Figure 2. Compare/contrast matrix.

Smith et al. (2005) suggest that teachers should use explicit instructional models when teaching text structure. Furthermore, Draper and her colleagues (2005) discuss the need for teachers to provide instruction on how “texts are used, created, and negotiated” (p. 18). Teacher modeling, guided practice, and independent student practice are important to this approach. Tompkins (2003) recommends the method of teacher think-alouds, where teachers speak aloud their own thinking processes while reading and writing text structures, thus giving students a model.

Draper et al. (2005) proposed that children’s comprehension increases through applying text structure strategies. Learning about text structures can help children make connections among content they read or write as well as provide support for students to focus on main ideas. Thus, text structures can support “the learning of new content and new literacy skills" (Draper et al., 2004, p. 19). Many studies have shown that elementary and middle school students' reading comprehension is positively affected by knowing and understanding text structure (Armbruster et al., 1987; Dickson, 1999; Hall et al., 2005; McGee, 1982; Williams et al. 2004; Williams et al., 2005).

Links Between Science and Literacy

As stated previously, literacy is essential to science, and science is interconnected with literacy; the two can be viewed as inseparable. Literacy processes allow for communication in and about science, which creates new understanding (Osborne, 2002; Norris & Phillips, 2003). Literacy is also the means by which science is written about and disseminated to the public. Yore (2005) explains that through speaking, reading, and writing, scientists share ideas and make verbal communication permanent. He states, "Spoken and written language form the symbol system that scientists use to construct, describe, defend, and present ideas" (p. 72). Only through literacy skills can the public read, discuss, and act on scientific issues that affect society. Thus, the *NSES* (NRC, 1996) recommend that children learn how to experience literacy processes in science classes.

Some educators believe that content area teachers, such as science teachers, should help their students develop literacy skills while learning discipline-specific content (Draper et al., 2005). Students need assistance to acquire "the knowledge and skills necessary to negotiate (e.g., read, listen, view) and create (e.g., write, speak, symbolize) the texts they encounter as part of content-area learning and knowing" (Draper, et al., 2005, p. 14). Because of the wide array of texts used in various content areas, students need instruction on negotiating and understanding discipline specific texts (Draper & Siebert, 2004).

This study incorporated compare/contrast text structure as a tool to increase students' science content knowledge using best practices based on research of how young children learn science effectively. Research validates the need for literacy inclusion in science content learning and also outlines the importance of best practice science learning methods for children.

CHAPTER 3

Methods And Procedures

This study investigated the effects of teaching text structure awareness as a tool to assist students' understanding of science content in a plant unit. This chapter describes the research design, the participants in the study, and the instruments and procedures that were used to conduct the study. The questions that guided this research were

1. Will first grade students in classrooms where text structure is integrated into science instruction perform better on interview examination than their peers who do not receive the integrated instruction?

2. Will first grade students in classrooms where text structure is integrated into science instruction perform better on explaining science concepts using text structure keywords than their peers who do not receive the integrated instruction?

Research Design

The research design for this study is quasi-experimental, consisting of two groups, a treatment group and a control group, from one elementary school. Three of the six first grade classes in this school were included in the treatment group, while the other three classes acted as a control group. The treatment group included the students of the three teachers using lessons prepared by the researcher that integrated text structure methods within science content lessons on plants. The teachers in the control group taught their students using the same science content as those in the treatment group, but in a manner of their own choosing. They did not use the lessons prepared by the researcher; nor did they include the integrated text structure methods. The unit of analysis in this study was the students. Students included in the study were given a pre- and post-test interview assessment that tested their knowledge of both science content and compare/contrast text structure language.

Participants

This study involved six classes of first grade students and their teachers. Each first grade class consisted of approximately 24 students. All six first grade classes were in a single elementary school with an enrollment of approximately 928 children in grades K-6. Of the student population, 96% of the students were white, 1% percent were Asian, 1% percent were African-American, 1% were Hispanic, and 1% had unknown ethnicity. Of the student population, 4% percent of students were eligible for free school lunch while 5% were eligible for reduced school lunch (Public School Review, 2003).

All six of the participating teachers were white females. The teachers all volunteered to participate in the study. Three of the six classroom teachers involved in this study expressed strong interest for their class to be included in the treatment group. These three teachers' classes made up the treatment group. The other three teachers expressed some interest in being included in the treatment group but agreed to participate in the control group. The researcher was one of the first grade teachers and was included in the treatment group of the study.

Parental approval for all students who participated in this study was obtained through a written consent form sent home with students (Appendix A). This consent form authorized students to be assessed on science content in a pre- and post-test. The consent form also authorized information from these tests to be analyzed and studied for this thesis. All data were kept confidential and student and teacher names were not disclosed in any results.

Teachers made a class announcement indicating that students who wished to be included in the study results could return the consent form with parental signature. Each student was given a form to take home and return. Only students who returned their forms granting permission were included in the study results. All first grade students received instruction on a plant unit with the pre/post assessment as part of the regular school curriculum regardless of participation in the study. However, only the treatment group students used the plant unit prepared by the researcher.

Instrumentation

The primary instrument in this study was a Pre/Post Assessment Protocol (Appendix B), developed by the researcher and administered as a one-on-one assessment to each student. The assessment contained two parts. The first portion evaluated the students' ability to sort leaves, flowers, and seeds into categories based upon similarities and differences noted by the student. The second portion of the test evaluated the students' usage of specific text structure key words. Items on the Pre/Post Assessment Protocol were carefully created by the researcher. The researcher matched lesson plan content directly with assessment protocol items. Background research was also conducted in the area of plant analysis by the researcher. A science content expert then evaluated all test items to ensure content validity. The expert examined the lesson plan concepts and test items and determined that they addressed the same content and were scientifically sound.

This assessment was administered to both treatment and control group students before the start of the unit and again after the unit was completed. The pre- and post-test method was most appropriate for this study as it allowed the researcher to examine variation in student responses from before and after the treatment.

For the first section of the assessment, students were asked to sort leaf, flower, and seed cards into groups. An example of one item the interviewer asked the students was, “What is one way you could sort these leaves into two groups?” Student answers that matched concepts taught during the science plant unit were given a score that was recorded on a Student Scorecard (see Figure 3*)*. If answers did not match, no score was given and responses were not recorded.

This Scorecard listed the concepts taught in the unit. Students’ were given a score ranging between zero-three points for each sorting method they demonstrated. Low scores indicated that the student did not sort any cards correctly or sorted only a few cards. More points were awarded if the student was able to sort more cards correctly. Students who correctly sorted one-two leaf cards according to a leaf characteristic (e.g. this leaf is red, this leaf is yellow) received a score of one in the Leaf Color category of the Student Scorecard. A student who sorted three-four leaf cards correctly according to a leaf characteristic (e.g. student placed two red leaf cards in one pile and two yellow leaf cards in another pile) received a score of two on the Student Scorecard under the Leaf Color category. Finally, students who sorted five-six or more leaf cards correctly (three leaf cards that are red, three leaf cards that are yellow) scored a three on the Student Scorecard on the Leaf Color category. Students were also asked to explain why they sorted the various leaves, flowers, and seeds as they did. Responses were recorded on the Student Scorecard. Students who gave explanations with correct science content scored one point under each category of leaves, flowers, and seeds.

Leaves

Concept	1-2 cards placed correctly Score 1	3-4 cards placed correctly Score 2	5-6+ cards placed correctly Score 3	Correct content in explanation Score 1	2 or more vocab words used in explanation Score1
Leaf Shape			✓	✓	
Leaf Color					
Leaf Vein Patterns					
Leaf Edges					

Vocabulary Keywords

Alike
Both
Different
But

Flowers

Concept	1-2 cards placed correctly Score 1	3-4 cards placed correctly Score 2	5-6+ cards placed correctly Score 3	Correct content in explanation Score 1	2 or more vocab words used in explanation Score1
Flower Shape					
Flower Color			✓		
Flower Petals			✓	✓	
Flower Size					

Seeds

Concept	1-2 cards placed correctly Score 1	3-4 cards placed correctly Score 2	5-6+ cards placed correctly Score 3	Correct content in explanation Score 1	2 or more vocab words used in explanation Score1
Seed Shape			✓	✓	
Seed Color			✓		
Seed Size					

Explanation

Leaves
1. There are small & them are big

Flowers
2. this only has a few flowers & they have more

Seeds
3. There are round, & them are tall

Figure 3. Student Scorecard showing categories included on test and student' s scores.

For the second portion of the assessment, the interviewer recorded the students' usage of the compare/contrast text structure keywords used in this study: alike, both, but, and different, while students explained how they sorted the leaf, flower, and seed cards. To measure students' awareness of text structure components during the pre and post interviews, their responses received one point in each of the categories if they used two or more compare/contrast text structure keywords and zero points if they used fewer than two keywords. Upon completion of the assessments, individual student scores were tallied and recorded.

As seen in the Student Scorecard example (see Figure 3), a student received 18 total points on the first portion of the assessment and zero points on the keyword section of the assessment. The student sorted five or six leaf, flower, and seed cards according to similarities and differences in leaf shape, flower color, flower petals, seed shape, and seed color and gave explanations for sorting that contained correct science content. The student used no keywords in the explanations; thus, no points were given for the keyword section of the assessment.

At the conclusion of the experimental period, all teachers completed a survey (Appendix C) asking questions regarding their teaching strategies during the unit. Of the five questions on the survey, four questions were filler questions while only one question was used to collect data for the study. The purpose of this survey was to gather information from teachers in the control group to evaluate any possible instruction of text structure methods that may have confounded study results. Of the three teachers included in the control group, two reported that they never used text structure strategies in teaching their science plant units, and one teacher reported that she sometimes used text structure strategies in teaching her unit.

Procedure

Two independent graduate students conducted the pre/post assessments of the students for all six first-grade classes involved in the study. These individuals were trained by the researcher to administer the assessments. Inter-rater reliability was secured during a pilot-test. Two students from a different school volunteered for the pilot study. Parental permission was obtained in advance. Both raters scored a pilot student's test. Then the raters compared their scores on the student test. Raters discussed any differences in their scoring of the same student. The researcher clarified any discrepancies. The two raters then tested the second pilot student to ensure inter-rater-reliability. When testing this student, the raters had 100 % agreement in their scoring. The provided training and practicing was necessary to secure accurate scoring (Johnson & Christensen, 2004).

The interviewers gave suggestions to the researcher for improving the layout of the Student Scorecard after the pilot testing was completed. Scorecard Revisions included spacing and formatting changes that did not alter the content of the Scorecard. A section was added for interviewers to write students' explanations for the sorting portion of the test. The keywords were also posted on the Scorecard to make recording more effective. The only changes made to the Pre/Post Assessment Protocol (Appendix B) were three words added to the end of each question: "into two groups." The interviewers recommended this change to make the questions easier for the students to understand.

Following administration of the pre-test, the three teachers in the treatment group taught a four week science unit containing twelve lessons prepared by the researcher. This science unit (Appendix D) integrated text structure instruction with science content. The students received thirty minutes of instruction, three days each week. The three teachers in the control group continued to teach using their regular science teaching methods that did not include the unit prepared by the researcher. At the conclusion of the four-week period, the post-test was administered to all students in the study. The unit began the middle of April 2008 and concluded in mid-May 2008. Data were then analyzed by the researcher.

Data Analysis

Following collection of the data, a *t*-test was conducted to compare the pre-test means of the control group with those of the treatment group in order to determine whether further analysis should be conducted using ANCOVA. One set of pre-test scores was used. This set of scores represented the sorting performance and correct science content explanations of students. The pre-test mean scores for the two groups were not significantly different from each other, thus ruling out the need to proceed with ANCOVA. Had these results been statistically significant, ANCOVA would have been used for the analysis, with pre-test scores as the covariate. Thus, *t*-tests were conducted to compare the difference between treatment and control group means on only the post-test scores for science content portion of the assessment. All analyses were performed using SPSS, a commercial statistical analysis program.

Data analysis was not performed for the second test portion evaluating students' usage of keywords due to the small number of students that used keywords during the assessment. Synonyms were not recorded consistently on the assessments, as the interviewers were not instructed to record them. Consequently, analysis could not be performed on students' usage of synonymous text structure keywords.

Limitations

The fact that the primary researcher for this study was also a teacher involved in the study may have posed a limitation to the study. The researcher/teacher may have had bias in teaching lessons as she had a broad scope of the entire study. Another limitation was the sample size with fewer than 50 students in each group. Thus this study may not be generalized to a larger population. Variance in student scores may also be the result of different teaching styles. Students have not been randomly selected for groups, but were assigned by class units to either the control or the treatment group. Because this study used an interview format in the pre and post-tests, reliability depended upon the ability and willingness of children to verbalize their knowledge. The data collected from assessments may also be a limitation if students experienced difficulty verbalizing their knowledge of science content asked in the assessment questions. However, despite these limitations, results may inform educators about some of the effects on student understanding of science content through integrating text structure in science teaching.

CHAPTER 4

Results

This study explored the effects of integrating a text structure strategy with a first grade science plant unit on student understanding of science content. Results of the data analysis are presented in this chapter.

It was anticipated that approximately 146 students would participate in the study. However this number was reduced to 60 students who were actually included in the study. There were 29 students included in the treatment group and 31 in the control group. Of the total 146 students in the six first grade classes, 23% of the students did not return their consent forms, 5% declined participation, and 41% were tested. The remaining 31% returned their consent forms but were not tested due to absences for either the pre or post assessments or because of time constraints. The assessments required a greater amount of time than expected and the graduate students conducting the assessments were not able to complete all assessments before they had to leave.

Students' abilities to sort items into groups and use specific compare/contrast text structure key words were assessed by pre and post interview tests. Students received separate scores for each of the two sections described above. A preliminary analysis of pre-test scores for the science content found no significant difference ($t_{58} = 1.92$; $p = .059$) between means of the control group ($M = 10.26$; $SD = 6.15$) and treatment group ($M = 13.38$; $SD = 6.39$) thus ruling out the need for using ANCOVA for further analysis. The remaining analyses were conducted using *t*-tests to compare post means of the two groups.

For the science content portion of the assessment, the difference in mean scores between the treatment group ($M = 16.79$; $SD = 5.54$) and the control group ($M = 11.52$; $SD = 5.38$) was found to be statistically significant ($t_{58} = 3.74$; $p < 0.001$). The pre-test score distribution is similar in the two groups, but the post-test scores for the treatment group are clearly higher.

In the second section of the test, none of the children used the keywords in the pre-test and only two children used two or more keywords in the post-test. One of these children was in the control group and used two keywords in the post-test. The other child who used keywords was in the treatment group and used six keywords during the post-test. Because so few children used the keywords during the assessment, statistical analysis was not performed. Synonyms of the keywords were not consistently recorded on the post-tests and thus were not able to be analyzed.

CHAPTER 5

Discussion

The purpose of this study was to examine the effects of teaching text structure as a tool to assist first grade students' understanding of science content in a unit of study on plants. Students in the treatment group that were taught science content using text structure awareness showed a greater understanding of science content than those in the control group as measured by the interview assessment. While pre-selected keywords were used by only two students, thereby preventing statistical analysis, it was observed that students often used synonyms of the keywords that were more common to first grade vocabulary. This conclusion was observed when the researcher read the first graders' post-test sorting explanations and noticed many words were synonymous to the keywords in students' explanations. However, synonyms of keywords were not recorded consistently by interviewers, as they were not instructed to specifically record synonyms. Therefore, analysis was not performed on keyword synonym usage.

Students in the treatment group participated in a series of 12 science lessons and learned about the compare/contrast keywords: alike, both, but, and different. Students observed real leaves, flowers, and seeds and discussed and wrote about similarities and differences among the various plants. During and after observation, students created sentences comparing the leaves, flowers, and seeds using the text structure keywords. The students in the control group were taught the same science content but in a manner chosen by their teachers. The students in the control group did not use the lessons prepared for the treatment group.

The design used in this study was modified from a traditional view of text structure study to accommodate the reading levels and developmental capabilities of the first grade students involved. While studies of text structure generally involve students reading and analyzing text, this study involved students creating well structured text and using keywords found in comparison/contrast text structure writing. Thus students looked at the relationship between ideas using these keywords to increase their understanding of plants.

Conclusions

On the first section of the test, students sorted leaves, flowers, and seeds into two groups based on similarities and differences. Students were also asked to give an explanation for their sorting choices. Students were awarded points for the number of cards sorted correctly and for explanations that reflected correct science content. Those included in the treatment group performed significantly higher on the post-test assessment than students included in the control group. This increased learning of science content may be a reflection of the treatment group students' increased awareness of how text is structured (Draper et al., 2005), as they had opportunities to discuss, write, and read well-structured text during the plant unit.

On the second portion of the test, students were assessed on their usage of four keywords in the pre- and post-test assessment. These keywords signified a comparison between objects. However, despite student usage of these keywords in class discussions and written work, most students did not use these keywords in the post assessment. Generally, when students were asked to give an explanation of how they sorted leaves, flowers, or seeds they responded with statements such as "these leaves have zigzag edges and these leaves have smooth edges," or "these seeds are the same because they are all round and these seeds are not." Although "*same*" was not one of the keywords in the study, and therefore received no score, it was used frequently by the first grade students and is synonymous with the key word "*alike*." This usage may be a result of the developmental stage of first graders as it was seen among all three classes in the treatment group (Horowitz et al., 2005). It became apparent after the analysis that synonyms of the keywords should have been accepted, as they were more developmentally appropriate for the students.

The students in the treatment group appeared to be more observant of differences and similarities among the leaves, flowers, and seeds in the post-test assessment than they were in the pre-test assessment. Generally, treatment group students noticed and described the structure of leaves, flowers, and seeds in greater detail than the control group students did. One class in the treatment group actually scored lower on their combined post-test scores than their pre-test scores. Upon further examination, it appeared that these students noticed a variety of differences and similarities among the leaves, flowers, and seeds; however, their sorting choices did not match the categories included on the assessment (see Figure 3).

The lower scores were also due in part to the students sorting the items into smaller, more homogeneous groups on the post-test. For example, students would sort six flowers into groups of "two yellow flowers" and "four flowers that are not yellow" on the pre-test, resulting in three points for sorting six cards. However, on the post-test they would sort only four flower cards into groups of "two yellow" and "two red," with the remaining two flowers unused because they were not red or yellow, resulting in a lower score. This may be a flaw in the scoring system. Because students were awarded points based on the number of cards sorted correctly, it did not account for the type of thinking and quality of sorting that occurred. Distinguishing that two flowers are yellow and other four flowers are not yellow appears to require less complex thinking than noticing that two flowers are yellow, two are red, and two are neither yellow nor red. This increased understanding may be a result of treatment group students' interaction with various texts in the instructional unit (Lind, 1997). Children in the treatment group had opportunities to discuss, write, speak, and draw their comparisons of leaves, flowers, and seeds, which may have aided in constructing new science knowledge.

Implications

Teachers that include text structure instruction in science lessons may help strengthen students' understanding of relationships between ideas and may thereby help students deepen their understanding of science content. Students' knowledge of the content in text may increase as they learn and use ways to organize the text to create meaning. Using text structures in this manner may especially help students studying complex science content.

It is also important that teachers ensure that lessons are related to childrens' life experiences and involve authentic inquiry. In this study, children used real flowers, leaves, and seeds in their explorations; all common to childrens' experiences. They also had opportunities to discuss questions and share findings with peers. Teachers can place science in a social context to stimulate thinking, sharing, and problem solving.

Future Recommendations

The data from this study suggest that when students are taught text structure as a tool to compare and contrast items, their understanding of science content knowledge is increased compared to students who do not participate in using text structure to learn the same material. This study is a first step in providing evidence that using text structure supports students in learning complex science material. In order to expand further knowledge in this area, researchers need to investigate the effects of text structure awareness strategies used in science content among older children, the testing instrument needs to undergo further refinements to more accurately reflect student understanding, and the results of this study need to be replicated among a larger population to generalize the results.

The findings from this study contribute to the body of educational literature by increasing current understanding of how to strengthen students' understanding of science content. This study has implications for improving classroom learning, as text structure may be used as a tool for assisting students in learning new material not only in science, but in other domains as well. It is exciting that raising students' text structure awareness enhances their science content knowledge.

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APPENDIXES

APPENDIX A

Parental Consent Form

Brigham Young University
Consent to Act as a Research Subject- Parent Consent

Purpose of Study: This study investigates the effectiveness of using literacy in a science plant unit in your child's first grade classroom. All six first grade classes will be invited to participate in this study. Students at Freedom Elementary School were selected to participate in this study because the researcher is a teacher at Freedom Elementary School and the first grade teachers expressed interest in participating in the study. Your first grade student is being asked to participate in the research study. This research will be conducted by Jamie Christensen, Master's Degree student, and will be supervised by Dr. Pamela Cantrell.

Procedures: All first grade students will receive instruction on a plant unit with a pre/post assessment as part of the regular school curriculum regardless of participation in this study. The instruction is a normal part of the class proceedings and no time will be taken away from normal class time. If you allow your child to participate in this study, his/her pre/post assessment scores will be included in study results. Photocopies of the tests with names removed will be evaluated by the researcher. No student names or information will be included in study results. You also give consent to having some of your child's school work collected. Again, student names will be removed and your child's information will remain strictly confidential. All data collected will be used for research purposes only.

Risks or Discomforts: It is anticipated that risks are minimal in this study. There may be potential discomfort to participants while answering assessment questions.

Benefits: There are no direct benefits resulting from involvement in this study. However, results from this study may improve the quality of science education in elementary schools.

Confidentiality: All participants' information will be kept confidential. Pseudonyms will be used in reporting any necessary data. All information will be kept in a cabinet with an iron clad lock and will only be accessible to the researcher and research supervisor.

Voluntary Nature of Participation: Participation in this study is voluntary. You have the right to refuse your child's participation and the right to withdraw him or her at any time during the study.

Questions about the Study: If you have any questions regarding this study you may call or e-mail Jamie Christensen (801)369-5675, jamielynnmail@yahoo.com, or Pamela Cantrell, PhD, Faculty Advisor, pamela_cantrell@byu.edu.

Questions about your Child's Rights as a Research Participant
If you have questions regarding your child's rights as a human subject and participant in this study, you may contact Christopher Dromey, PhD, IRB Chair, 133 TLRB; Christopher_dromey@byu.edu; phone (801) 422-6461.

Agreement: Your signature below indicates that you have read, understood, and received a copy of the above consent, and give permission for your child to participate in this research and accept the benefits and risks related to the study. Your signature also indicates that you have been told that you may change your mind and withdraw your consent to participate at any time.

☐ Yes, my child's results may be included in the research

☐ No, my child's results may not be included in the research

Student Name: ______________________________________ Date: _____________

Parent Name: _______________________________________

Parent Signature: ____________________________________

APPENDIX B

Pre/Post Assessment Protocol

Questions for sorting leaf cards

1. What is one way that you can sort these leaf cards?

(After question 1: Why did you sort these leaves this way?)

2. What is another way you can sort these leaves?
3. Can you think of another way?
4. How else can you sort these leaves?
5. Is there another way you can sort these leaves?

(Continue to ask the student until they have sorted the leaves in all the ways they can)

Questions for sorting flower cards

1. What is one way that you can sort these flower cards?

(After question 1: Why did you sort these flower cards this way?)

2. Can you think of another way you can sort the flower cards?
3. Is there another way you can sort the flower cards?

(Continue to ask the student until they have sorted the leaves in all the ways they can)

Questions for sorting seed cards

1. How can you sort these seed cards?

(After question 1: Why did you sort these seed cards this way?)

2. Can you sort them another way?
3. What is another way that you can sort them?

(Continue to ask the student until they have sorted the leaves in all the ways they can)

APPENDIX C

Teacher Survey

This survey is part of a study that investigates the effectiveness of using literacy in a science plant unit in first grade classrooms. This research will be conducted by Jamie Christensen, Master's Degree student, and will be supervised by Dr. Pamela Cantrell. Your participation in this survey is voluntary. All information will be kept confidential and will be used for research purposes only. Thank you!

Instructions: Please indicate how often you used the following methods in this science unit. Mark your responses below each question.

1. I used non-fiction books in this science unit.

1	2	3
Never	Sometimes	Often

2. I used fictional books in this science unit.

1	2	3
Never	Sometimes	Often

3. I used inquiry methods as part of my science teaching.

1	2	3
Never	Sometimes	Often

4. I used text structure strategies in this science unit.

1	2	3
Never	Sometimes	Often

5. I used comprehension strategies in this science unit.

1	2	3
Never	Sometimes	Often

APPENDIX D

Lesson Plans

Text Structure/ Science Plant Unit Lesson Plan: Day 1 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td><u>Objective:</u>
Students will identify keywords and describe how to compare and contrast

Concepts Taught:
Text structures help us compare items</td>
<td>
1. Today we are going to learn how to compare two items. Put two different shoes up where students can see (you may want to ask for two student shoes).
2. Teach the students the words: Alike, different, both, and but. (Use prepared word cards).
3. Now, discuss as a class how the shoes are different and the same.
4. As a shared writing activity use the prepared chart to write how the shoes are alike and different. Use the words learned on the word cards in the writing.
5. Read the chart together as a class.
6. Show the children the matrix chart.
7. As a class, fill in the matrix using the two shoes.
8. Look over the chart together. Discuss.
Possible Class Comparison Chart (Example)
<table><tr><td>Both the sneaker and the sandal have thick soles. But the sandal has Velcro and the sneaker does not have Velcro. Both are alike, because they are both black. But they are different because the sneakers have stripes</td></tr></table>
Possible Class Matrix Chart (Example)
<table><tr><td>Alike</td><td>Different</td></tr><tr><td>Both Black
Both have thick soles</td><td>Velcro vs. ties
Stripes vs. no stripes</td></tr></table>
</td>
<td>• Prepared word cards
• Prepared chart & matrix
• 2 different shoes
• Marker</td>
</tr>
</table>

- Note to the teacher—This is a content free lesson (meaning that no scientific concepts will be taught). The purpose of the lesson is to teach the text structure of compare and contrast that will be used in future science lessons.

***Pictures may be used instead of writing on all charts**

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td>Objective:
Students will compare and contrast leaf shapes

Concepts Taught:
Leaves have different

shapes</td>
<td>1. Read aloud the picture book: Leaf Man, by Lois Ehlert.
2. Divide students into groups of 4-5. Give each group a Maple leaf and an Aspen leaf. Ask the students to look carefully at the leaves and look for differences and similarities in their shapes. Have them do crayon leaf rubbings in their leaf journal.
3. Show students the comparison chart. As a shared writing activity, and using the keywords learned in lesson 1, write- as a class- how the shapes of the leaves are similar and different.
4. Fill in the matrix as a class.
5. While filling in matrix as a class, have students fill in their student matrices.

Possible Class Sentence
<table><tr><td>The Maple leaf is pointy but the Aspen leaf is round. Both leaves are curvy.</td></tr></table>
Possible Class Matrix (Example)
<table><tr><td>Alike shapes</td><td>Different shapes</td></tr><tr><td>Both have some curvy shapes</td><td>The Maple has long points in its shape and the Aspen doesn't.
The Aspen looks like a circle, but the Maple looks like a handprint shape.</td></tr></table></td>
<td>• Prepared word cards
• Prepared charts
• Student matrices
• Plant journal
• Markers
• Crayons
• Book: Leaf Man</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 3 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td><u>Objective:</u>
Students will sort leaves by color

Concepts Taught:
Leaves are different colors</td>
<td>

Read aloud the picture book: <u>Red Leaf, Yellow Leaf</u> by Lois Ehlert.
Show students the comparison chart and matrix used in the previous lesson.
Show students the two new leaves they will compare today. Allow them to look at the leaves and discuss with their group how the leaves are similar and different according to color. Have them do a crayon leaf rubbing of their leaves in their leaf journal, coloring the leaves according to their true color.
Use the keywords to write on the chart about similarities and differences in color among the leaves collected so far. Do this as a class.
Compare the color of the leaves on a class matrix. Students can do this same process on their own matrices.
Divide students into groups and distribute leaf cards. Allow students to sort leaf cards in a group based on color. Discuss similarities and differences in color throughout this process.

Possible Class Sentence
<table><tr><td>The leaves are different colors, orange and yellow. But one leaf has orange tips.</td></tr></table>

Possible Class Matrix (Example)
<table>
<tr><td>Alike in color</td><td>Different in color</td></tr>
<tr><td>Both have some orange</td><td>One leaf is mostly orange and one leaf is mostly yellow. The orange leaf has no yellow.</td></tr>
</table>
</td>
<td>

Prepared word cards
Prepared charts
Student matrices
Plant journal
Pencils
Marker
Crayons
Book: <u>Red Leaf, Yellow Leaf</u>

</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 4 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr><td><u>Objective:</u>
Students will discuss various vein patterns in leaves.

Concepts Taught:
Leaves have different vein patterns</td><td>1. Display two new leaves for students to see. Distribute these new leaves to each group of students. Have the students do a crayon leaf rubbing in their leaf journal.
2. Show students the previous comparison charts. Briefly review the various shapes and colors of leaves.
3. Ask students to see if they can discover what a vein pattern is on their leaves. Discuss as a class.
4. Pass out the leaf cards in a group and ask students to examine the various leaf patterns and look for similarities and differences. Ask students to generate words to describe vein patterns.
5. Discuss variations in vein patterns as a class. Write a sentence on the writing chart as a class that compares the vein patterns noticed in the leaves.
6. Write down comparisons on class matrix while students write down/draw their comparisons on their own matrices.

Possible Class Sentence
One leaf has a long, skinny vein pattern. But the other leaf has a vein pattern that looks like a handprint.

Possible Class Matrix for Vein Patterns (Example)<table><tr><th>Alike vein patterns</th><th>Different vein patterns</th></tr><tr><td>The leaves are alike because they both have several veins.</td><td>They are different because the veins in one leaf are long and skinny. But, on the other leaf the veins branch out like a handprint.</td></tr></table></td><td>• Prepared word cards
• Prepared charts
• Student matrices
• Plant journal
• Pencils
• Marker
• Crayons
• Leaf cards</td></tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 5 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td><u>Objective:</u>
Students will compare and record their observations of leaf edges

Concepts Taught:
Leaves have different edges</td>
<td>

Display three leaves for students to see. Distribute these new leaves to each group of students. Have the students do a crayon leaf rubbing in their leaf journal.
Ask students to observe the edges of the leaves and compare leaves that have similar or different edges.
Distribute leaf cards to each group and ask students to sort the cards according to leaf edge.
As a class discuss what the children learned from sorting the cards according to edge types.
Briefly write down a comparison sentence describing various leaf edge types using words generated by the class.
Write/draw these differences/similarities on the class matrix while students do the same on their student matrices.

Possible Class Sentence
<table><tr><td>One leaf has saw-tooth edges but the others have curved edges.</td></tr></table>
Possible Class Matrix (Example)
<table>
<tr><td>Alike edges</td><td>Different edges</td></tr>
<tr><td>Two leaves have curved edges.</td><td>The two curved edges leaves are different because one has a jigsaw pattern and one has a rounding pattern. One leaf is different than the other two because it has a saw-toothed edge.</td></tr>
</table>
</td>
<td>

Prepared word cards
Prepared charts
Student matrices
Plant journal
Pencils
Marker
Crayons
Leaf cards

</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 6 *Time: ~ 30 minutes*

Objective/Concepts Taught	**Plan**	**Materials Needed**
<u>Objective:</u> Students will observe leaf characteristics using a hand lens Concepts Taught: A hand lens magnifies leaf characteristics	1. Show students a hand lens. Ask students to share their previous knowledge on microscopes and/or hand lenses. 2. Model how to use these tools and then invite students to examine their leaf cards using the hand lens or the microscope. 3. Have students draw what they see in their plant journal. **Continued on next page**	• Prepared word cards • Prepared charts • Student matrices • Plant journal • Pencils • Marker • Crayons • Hand lens • Leaf cards

Objective/Concepts Taught	**Plan**	**Materials Needed**
<u>Objective:</u> Students will sort leaves according to specific leaf characteristics Concepts Taught: Leaves can be sorted in different ways	1. Review with the students the various ways they have looked at and sorted leaves over the past few lessons. Show students the previous comparison matrix charts as a part of this process. 2. Divide the children into groups of 4-5. Give each group the prepared bag of leaves. Ask the groups to sort the leaves into groups based on similarities they observe. They may want to choose size, shape, color, etc. Ask students to glue their leaves onto a large piece of construction paper and label the various groups of leaves. 3. Allow students to present their leaves to the class and discuss how they labeled their groups.	• Plant journal • Markers • Bag of Leaves • Construction paper • Glue

Text Structure/ Science Plant Unit Lesson Plan: Day 7 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr><td><u>Objective:</u>
Students will compare flowers

Concepts Taught:
Flowers have different numbers of petals</td><td>1. Read aloud the picture book: <u>The Empty Pot</u> by Demi. Point out the variety of flowers shown in the book.
2. Give students two different types of flowers. Have them draw the plants in their plant journal. Allow the students time to discuss the differences and similarities of the plants. Have them look at the number of petals in each flower. They may pull them apart to count if needed.
3. Use the comparison chart to write about these flowers as a class.
4. Fill in the flower matrix as a class. Students fill in their own matrices during this time.
5. Discuss

Class Comparison Sentence
The flowers were different because they had different numbers of petals.

Possible Class Matrix (Example)
<table><tr><td>Alike in petals</td><td>Different in petals</td></tr><tr><td>The mum and the tulip both had petals.</td><td>The mum had lots of petals, but the tulip had few petals.</td></tr></table></td><td>• Prepared word cards
• Prepared chart
• Student matrices
• Plant journal
• Flowers (two different kinds)
• Pencils
• Marker</td></tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 8 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td><u>Objective:</u>
Students will compare flower sizes

Concepts Taught:
Flowers are different sizes</td>
<td>
1. Give students four different types of flower plants. Have them draw the plants in their flower journal. Allow them to discuss the flowers and talk about similarities and differences of the sizes of the flowers.
2. Use the comparison chart to write about these flowers as a class.
3. Fill in the class matrix, comparing the flowers. Ask students to fill in their own matrices during this time.

Possible Class Sentence
Two of the flowers are alike in size because they are both big. The other flowers are different because one is medium sized and one is small.

Possible Class Matrix Chart (Example)
<table>
<tr><td>Alike in size</td><td>Different in size</td></tr>
<tr><td>Iris and Mum are big.</td><td>The carnation is medium sized but the African violet is small. These are different from the big Iris and Mum flowers.</td></tr>
</table>
</td>
<td>
• Prepared word cards
• Prepared chart
• Student matrices
• Plant journal
• Flowers (four different kinds)
• Pencils
• Marker
</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 9 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td>Objective:
Students will discuss similarities and differences of shape among various flower cards.

Concepts Taught:
Flowers are different shapes</td>
<td>1. Show students the flowers used so far in the lesson plans. Have them review their drawings of these plants in their flower journal and discuss what they noticed or learned during the past two lessons.
2. As a class, discuss the differences and similarities among these flowers according to their shape. Groups of students can compare the flower picture cards according to shape.
3. Use the comparison chart to write about these flowers as a class.
4. Fill in the class matrix chart while students fill in their own matrices during this time.
5. Discuss as a class.

Possible Class Sentence
<table><tr><td>Some of the flowers were similar in shape but some were different.</td></tr></table>
Possible Class Matrix Chart (Example)
<table><tr><th>Alike in shape</th><th>Different in shape</th></tr>
<tr><td>The rose and the carnation are round in shape.
The iris and lily are long.</td><td>The iris and lily are different from the rose and the carnation because one is skinny and long but the others are round.</td></tr></table>
</td>
<td>• Prepared word cards
• Prepared chart
• Student matrices
• Plant journal
• Pencils
• Marker
• Flower picture cards.</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 10 *Time: ~ 30 minutes*

Objective/Concepts Taught	**Plan**	**Materials Needed**
Objective: Students will discuss their observations of various seed shapes. Concepts Taught: Seeds have different shapes	1. Read aloud: The Carrot Seed, by Ruth Kraus 2. Discuss what the students already know about seeds. 3. Give students prepared seed packet with six different types of seeds. Have them sort the seeds and discuss similarities and differences. Ask them to compare the shapes of the seeds and discuss their observations. 4. Have them glue the seeds in their seed journal. 5. Discuss what the students learned in a class discussion.	• Prepared word cards • Prepared chart • Student matrices • Plant journal • Pencils • Marker • Prepared seeds • Glue

Text Structure/ Science Plant Unit Lesson Plan: Day 11 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td><u>Objective:</u>
Students will write about variations in seed colors.

Concepts Taught:
Seeds are different colors</td>
<td>
1. Review children's seed sorting journal from the previous class period. Ask students to identify the colors of the seeds and notice similarities and differences.
2. Use the comparison chart to write about these seed color differences and/or similarities as a class.
3. Fill in the seed matrix as a class. Students fill in their own matrices during this time.
4. Discuss results as a class.

Possible Class Sentence
<table><tr><td>Some of the seeds were a brown color. But other seeds were different colors.</td></tr></table>
Possible Class Matrix Chart (Example)
<table>
<tr><td>Alike in color</td><td>Different in color</td></tr>
<tr><td>Some of the seeds were a brownish color.</td><td>The pumpkin seed was a cream color and the corn seed was yellow. So, those seeds' colors were different from the brown seeds' colors.</td></tr>
</table>
</td>
<td>
• Prepared word cards
• Prepared chart
• Student matrices
• Plant journal
• Pencils
• Marker
• Prepared seeds
</td>
</tr>
</table>

Text Structure/ Science Plant Unit Lesson Plan: Day 12 *Time: ~ 30 minutes*

<table>
<tr><th>Objective/Concepts Taught</th><th>Plan</th><th>Materials Needed</th></tr>
<tr>
<td>
<u>Objective:</u>
Students will record their observations of differences and similarities of seeds sizes.

Concepts Taught:
Seeds are different sizes
</td>
<td>

Read aloud the picture book: <u>The Tiny Seed</u>, by Eric Carle
Review what students learned about seeds during the past two lessons.
Give students prepared seed packets with four new seeds. Have them sort the seeds and glue them on their seed sorting journals along with the other six seeds they have already collected.
Ask students to examine the seeds and notice similarities and differences in size among the seeds. Have students discuss their observations with the members of their table.
As a class write down what the students discovered while comparing seed sizes. Record information in the class matrix while students record information on their own matrices.
Briefly discuss what was learned in a class discussion.

Possible Class Sentence
<table>
<tr><td>We observed that some seeds were alike in size and some were different.</td></tr>
</table>
Possible Class Matrix Chart (Example)
<table>
<tr><th>Alike in size</th><th>Different in size</th></tr>
<tr><td>The mustard seed and the carrot seed were both small.
The pumpkin seed and the bean seed were both big.</td><td>The small seeds were different sizes than the big seeds. Some seeds were medium sized.</td></tr>
</table>
</td>
<td>

Prepared word cards
Prepared chart
Student matrices
Plant journal
Pencils
Marker
Prepared seeds
Glue

</td>
</tr>
</table>