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ABSTRACT

Title of Dissertation: MOTIVATIONAL AND COGNITIVE INFLUENCES ON CONCEPTUAL KNOWLEDGE: THE COMBINATION OF SCIENCE OBSERVATION AND INTERESTING TEXTS

Emily Anderson. Doctor of Philosophy. 1998

Dissertation directed by: Professor John T. Guthrie
Department of Human Development

This study examined the relationship between types of texts and science observation, and their effects on reading motivations and conceptual knowledge. Motivations to read include challenge, involvement, curiosity, and interest. Interest in a topic enhances the amount, depth, and fullness of conceptual learning from a text about that topic. Constructing knowledge when multiple texts are present also involves a process of searching for, comprehending, and integrating information from multiple sources. This search process is dependent on what information students attend to, what information is important and relevant to the task, motivational variables, the use of cognitive strategies, self-regulation strategies, and motivations for understanding. Students’ learning goals and questions, in turn, may depend on their experiences.
Science observations, involving multi-sensory experiences with concrete objects, are intriguing. When conditions are favorable, readers can gain knowledge and a sense of self-efficacy or self-competence, through processing expository text, especially when students have a personal reason or goal for gaining this knowledge. Show interest in the topic, and can be somewhat self-determined. This process of engagement can be influenced by classroom contexts. The study was conducted in six self-contained, multicultural classrooms in a metropolitan area in the U.S. using a 2x2 factorial experimental design. The factors were Interesting Texts and Science Observation. There were three treatment conditions and one control group in the study. This study showed that the students in the treatment group who conducted science observations and read interesting texts, gained more conceptual knowledge than any other condition. This study extends the CORI and Explorers program research to show that these two instructional factors are in fact, dynamic and statistically significant in terms of motivating elementary age students to read and to gain conceptual knowledge from expository text. The results of this study speak to the domain of science, making a valid case for the inclusion of texts. The current study found that pure discovery learning, without access to text, did not yield significant knowledge gains.
MOTIVATIONAL AND COGNITIVE INFLUENCES ON CONCEPTUAL KNOWLEDGE: THE COMBINATION OF SCIENCE OBSERVATION AND INTERESTING TEXTS

by

Emily Anderson

Dissertation submitted to the Faculty of the Graduate School of the University of Maryland, College Park in partial fulfillment of the requirements for the degree of Doctor of Philosophy 1998

Advisory Committee:

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Professor Patricia A. Alexander
Associate Professor Stanley W. Bennett
Professor Mariam Jean Dreher
Associate Professor Allan L. Wigfield
DEDICATION

In memory of

Kevin M. Simmons, Ph.D., who was my inspiration.

and whose life changed the way I see the world.

And to Norm Slaymaker, who gave me the chance to realize

that anything is possible: life is what we make it!
ACKNOWLEDGEMENTS

This journey began over ten years ago. As I taught illiterate adult how to read, I was inspired when I saw how learning to read unlocked doors of possibilities for these people. I was also amazed how they had fallen through the cracks of the public school system. I decided then, that I wanted to teach children to read to prevent this problem in adulthood. That decision led to classroom teaching, and eventually to my need to reach as many children as possible. This dissertation is the beginning of a lifetime commitment to making a difference for children, to help them become life-long learners. I believe when children can read, they are empowered, and anything is possible.

First, I would like to thank my advisor and mentor, Dr. John T. Guthrie for guiding me on this expedition of learning. You taught me the importance and beauty of research. You challenged me, taught me, and supported me for four years. You believed in me when I did not believe in myself. I am a better scholar, teacher, researcher, writer, and person for having associated with you. Working with you was an experience of a lifetime. We are a great team, and I could not have done this without your wisdom and experience, not to mention your sense of humor.

Next, I'd like to thank Dr. Patricia Alexander, Dr. Stan Bennett, Dr. Jean Dreher, and Dr. Allan Wigfield for your support and feedback on my dissertation. You were a wonderful committee of expertise. You all added richness to my doctoral training as teachers, colleagues, committee members, and friends. I'd also like to thank Dr. John O'Flahavan for your support and friendship during the past four years. You have added much to my research training, and knowledge base with emergent reading and school change, as well as being a wonderful friend and colleague. Thanks also to my graduate student friends who were so much fun to be in school with, and who inspired me with their greatness.
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CHAPTER 1

Introduction

Description of the Problem

There are many ways to motivate young children to become better, more strategic readers. This study examines the relationship between instructional factors that may contribute to students’ intrinsic motivations to read and potential conceptual knowledge gains from reading expository texts. The specific problem this dissertation explores is: What are the effects of certain types of texts and science observation on intrinsic motivation to read and the acquisition of conceptual knowledge?

Reading comprehension is a broad and diverse concept. It includes narrative text for response, and interpretation and expository text for seeking information and gaining knowledge. Narrative text is an important genre for reading comprehension and ubiquitous in the research literature. Some view narrative reading as an active, analytical process that is both motivating and pleasurable (Britton, 1982; Cox & Many, 1992; Fish, 1980; Rosenblatt, 1978). Many reader response researchers view information seeking via expository text reading as unmotivating, unrewarding, and passive (Alexander, 1997). Expository text has been characterized as dense or “inconsiderate” that is more likely to bore readers than to engage them (Armbruster, 1984). Within school settings, expository text is often used to complete a task, while narrative text may be read for personal enjoyment or pleasure (Alexander, 1997). Expository text in school also comes in the form of textbooks or supplementary
materials (Shymansky, Yore, & Good, 1991; Yore, 1991). In narrative texts, there is a common story structure that includes a plot, a setting, characters, a problem to be solved, and a resolution. Expository text also has common structural elements such as cause-effect, compare-contrast, and descriptive, yet these structural elements may not always be well framed and can vary from paragraph to paragraph (Anderson & Armbruster, 1984; Taylor & Beach, 1984). Because the structure of expository text may be more difficult to follow, importance may also be more difficult to ascertain (Jetton, Alexander, & White, 1992).

So what are the classroom conditions that are necessary to foster students' self-efficacy and competence as expository text readers? How can instruction be more motivating and engaging to students with the use of expository texts? This study focuses on classroom factors that may enhance student engagement in learning from expository texts. Specifically, this study explores the relationship between types of texts and science observation and their effects on intrinsic motivations to read, situational interest, and conceptual knowledge gained from reading expository texts.

One factor that influences conceptual knowledge gained from text is motivation to read. Motivations to read may include the use of learning goals (Ames, 1992; Dweck & Leggett, 1988), which may serve as a purpose to gain knowledge and answer questions. Teaching children to search for information to satisfy their questions is an important step in gaining conceptual understanding. It seems reasonable that in order for this search to be successful, students need to be motivated to search for answers. Although it is possible for students to gain conceptual understanding with extrinsic
motivations (e.g., compliance, competition). Students' intrinsic motivations to learn (e.g., curiosity, involvement) about the things they wonder about contributes to deep understanding of concepts (Guthrie, 1996). Interest in a topic enhances the amount, depth, and fullness of conceptual learning from a text about that topic (Alexander, Kulikowich, & Jetton, 1994). Intrinsic motivations such as involvement, curiosity, and challenge lead students to understand the substance deeply, and to use their new knowledge to solve problems in the content area (Guthrie, Van Meter, Hancock, McCann, Anderson, & Alao, in press). Cognitive strategies are empowered by students' motivations to understand and explain the world around them. Students are engaged in the learning process when they are both strategic and motivated (Guthrie & Wigfield, 1997). Motivation and strategy use are a strong combination that can lead to reading engagement and increased conceptual knowledge gains.

This process of engagement can be influenced by classroom contexts (Guthrie & Alao, 1997). Intrinsic motivational constructs are defined in terms of theories of goal orientations, beliefs, and values (Wigfield, 1997). These goals, beliefs, and values are associated with children's performance in school, their choice of activities, and how well they persist at these activities, which are three important indicators of motivation (Eccles, Wigfield, & Schiefele, in press; Graham & Weiner, 1996; Pintrich & Schunk, 1996; Wigfield, 1997). For this dissertation, I am focusing specifically on goal orientations as a motivation for reading. Students who have learning as a goal for reading tend to be intrinsically motivated to gain conceptual knowledge as opposed to students whose goal is to get a good grade (Wigfield, 1997). Students' engagement in
reading is facilitated when they are intrinsically motivated, have learning goals, and can make their reading personal and meaningful to them (Wigfield, 1997).

To increase intrinsic motivations and interest, the variable of science observation was examined. Science observation in this study involves the use of multiple senses to interact with a live animal. When students are allowed to touch and watch a live animal such as a cricket or a frog, observing the animal’s natural behaviors, their natural wonder and curiosity are piqued. The students are motivated and interested: discovery is beginning, and a connection to their world has been made (Guthrie et al., in press). Other science observations may include laboratory activities, hands-on activities, demonstrations, and the use of manipulatives to construct meaning of concepts and ideas. The rationale for experiential learning is to discover, question, and think, which is where conceptual understanding begins (Guthrie et al., in press).

In this experimental study, the variable of science observation was manipulated to increase attention, interest, and motivation for half of the students. From a total of four treatment conditions, two groups of students were provided with opportunities to observe live animals. Two groups of students did not observe. One science observation group also read presumably interesting texts. The second science observation group did not read any text. I was interested in the effect of science observation on conceptual knowledge gains, situational interest, and reading motivations. The investigation explored the differences between groups of students who observed live animals and groups of students who did not observe live animals. The other two groups in the study will be described with the second factor in the study, interesting texts.
A second factor that influences conceptual knowledge gained from text includes the specific characteristics of texts. For this study, interesting texts refer to trade books that are described as having the following characteristics: structural features of a book (e.g., table of contents, index); content confined to a specific domain; composed by one or two authors; attractively illustrated with explanatory diagrams and vivid photographs; relatively short in length; developmentally appropriate; and perceived as attractive and inviting to read.

Expository text, like narrative text, is dynamic. Despite the negative aspects of expository text characterized in the literature, there are also motivating and important aspects of exposition. Pintrich (1994) claims that knowledge-seeking through expository texts, as well as through narrative or mixed texts, is essential to the development of a reader's knowledge of self. Through processing interesting text, readers can gain knowledge and a sense of self-efficacy (Bandura, 1977, 1989, 1993), or self-competence (Harter, 1990, 1996), especially when students have a personal reason or goal (e.g., Ames & Ames, 1985, 1989; Dweck & Elliot, 1983; Nicholls, 1984) for gaining this knowledge, show interest in the topic (Alexander, Kulikowich, & Schulze, 1994; Hidi, 1990; Schiefele, 1991b), and can be somewhat self-determined (Deci, Vallerand, Pelletier, & Ryan, 1991; Ryan, 1993). Interest in a topic enhances the amount, depth, and fullness of conceptual learning from a text about that topic (Alexander, Kulikowich, & Jetton, 1994).

Many researchers have examined the influence of interest on learning from expository texts (see Hidi, 1990; Hidi & Baird, 1986; Schiefele, 1991b, 1992, 1996;
Wade, 1992). There have also been numerous studies in which individual or personal interest has been found to have a positive relationship with text learning (Alexander, Kulikowich, & Jetton, 1994; Asher, 1980; Baldwin, Peleg-Bruckner, & McClintock, 1985; Entin & Klare, 1985; Renninger, 1989).

To examine growth of conceptual knowledge, the use of interesting texts was an experimental variable. The use of interesting texts was manipulated to examine the differences between groups of students' conceptual knowledge gains from text. Again, I was interested in the effect of reading interesting texts on conceptual knowledge gains, situational interest, and reading motivations. Two groups of students read interesting texts. One of these interesting texts groups also did science observation. The other group read interesting texts only. Two groups did not read interesting texts. Out of the two groups that did not read interesting texts, one did not read any text: the other group (control group) read their regular science text, which, for the purpose of the study, was not considered interesting.

The rationale for using a 2x2 factorial design is based on theoretical and pragmatic reasons. Theoretically, science observation and reading interesting texts are, in fact, two different and separate factors. Each of these factors may have an affect on students' motivations to read and conceptual knowledge gained during the week of treatment. Combining or separating these factors of science observation and reading interesting texts is not artificial in theory or in practice.

Pragmatically, these factors may or may not be separated in an instructional program. There are many times when children may read interesting texts and science
observation is not included. Likewise, there are instances when science observation is used in a classroom, without interesting texts, or texts of any kind to supplement the activity of observing. The combination of these two factors, however, is the instructional condition that may or may not prove to be more powerful than having just one of the factors alone in an instructional setting.

Given the fact that this study is examining two factors, science observation and reading interesting texts, the data analysis includes an analysis of covariance (ANCOVA) in which these factors are compared separately, and in tandem in a 2x2 design. These three conditions are compared to students' regular classroom science instruction as the control group. to explore which condition produces the most conceptual knowledge gains and motivations for reading. An interaction between these two factors would indicate that the combination of these two factors has a different effect on the students' conceptual knowledge gains and motivations to read when compared to the factors in isolation and the control group. Obtaining a statistically significant interaction between these two variables is the focus of the study because it would show the synergistic power of these two factors in an instructional setting.

I expected the two variables of science observation and interesting texts to interact. I predicted the combination of science observation and reading interesting texts would yield higher conceptual knowledge gains and higher levels of motivation than the other three treatment conditions. I expected that reading interesting texts would increase conceptual knowledge more for the students who observed than it would for the students who read interesting texts and did not observe. There are many reasons
for this hypothesis. First, conceptual knowledge is being learned from reading. When
students observe live animals, their interest is heightened, which leads to reading about
these animals. When students read interesting texts about crabs and turtles, they will
also gain knowledge about these animals.

Second, science observation may lead to self-questioning processes that are the
result of direct interaction and contact with live animals. The questions students have
from their observation can be answered by reading interesting texts. When students
observe live animals and do not have interesting texts to read, their questions go
unanswered. The observation alone may in fact be motivating, but students will not
gain knowledge or become informed without reading interesting texts about the topic.

Moreover, science observation creates different levels of questions. Students
who observe live animals are curious about them. This leads to many kinds of
questions, which in turn lead to subtopics. For instance, students may wonder how
many legs a hermit crab has. Upon further observation, students may wonder why two
of the hermit crabs' legs stay inside its shell. Then, upon further observation, students
may wonder if hermit crabs come out of their shells and when. Without observation,
the subtopic questions of interest and curiosity are not generated. The observation
creates the opportunity for many kinds of questions to be asked. Without reading
interesting texts, these questions will not be answered.

Third, interesting texts may help students organize and validate the information
they gain through observation. Reading interesting texts may help students organize
what they want to learn about the animal. For instance, after observing a hermit crab, a
student may want to read about the functions of pincers. Then, the student may want to read about predators, which may lead to the habitat of a hermit crab. Reading validates the information gained in the observation. Students may count eight legs on a hermit crab after an initial observation. Upon reading about crabs, students may read that all crabs have ten legs. A second observation may reveal two smaller, hidden legs on the crab’s body that were hidden in the shell, thus validating the information seen and read.

Fourth, science observation helps students build their knowledge to form principles and explain this knowledge in a coherent manner. Observing live animals creates prior knowledge or builds upon a student’s prior knowledge. When prior knowledge about a hermit crab is created for a student who has never seen one, they are able to read interesting texts about hermit crabs and build upon this knowledge. Observation also provides students with information about the features and functions of the animals. Students can count the legs on a hermit crab, watch a hermit crab retract into its shell when approached, and can observe a hermit crab pinching a piece of apple with its pincer. Reading interesting texts helps elaborate and deepen knowledge about these features and functions. Observation also provides information about the animals’ habitats. Reading about these animals’ habitats and life cycles broadens students’ conceptual understanding and deepens knowledge of forms and functions to systemic and relationship-oriented concepts and principles. Once this principled knowledge (Alexander, Kulikowich, & Jetton, 1994) has been built, students can explain (Chi et al., 1994) this knowledge in a cohesive manner. Observation facilitates explanations (Chi
et al., 1994) because students can remember what they observed and connect this knowledge to information they read.

Fifth, and perhaps most importantly, the reason science observation combined with reading interesting texts is powerful, is that science observation and reading interesting texts induces additional observation, which is knowledge generating. The relationship becomes reciprocal and symbiotic. Students observe, ask questions, and then read interesting texts to find answers. Reading may invoke more questions, which may lead to more observation, which may lead to additional reading. The relationship between observing and reading interesting texts creates a circular pattern of growth. When both variables are present, they expand each other through a synergistic relationship. This synergy leads to deep conceptual knowledge gains and long-term motivation to read.

The constructs used in the study will be defined next.

Definition of Constructs

Interesting texts. The definition of interesting texts for this dissertation includes the description of interesting texts made by Schraw, Bruning, and Svoboda (1995) as having three qualities: the text is easy to comprehend, has vivid details, and contains relevant information. In addition, the interesting texts used in this study have structural features of a book (e.g., table of contents, index): each section of text is composed by one or two authors; and the passages are attractively illustrated with explanatory diagrams and vivid photographs.
Science observation. Science observation is defined as watching, interacting with, examining, and manipulating (e.g., touching, holding) a concrete object (e.g., a cricket): in this case the object is specific to life science. Observation may include feeding the cricket and recording what happens. Interaction may be drawing a picture of a cricket and labeling its parts, which requires careful observation and attention. Observation may be holding the cricket and listening to it chirp. Students are able to observe and interact directly and observe the cricket's behaviors by using multiple senses (e.g., sight, touch, hearing).

Intrinsic motivation to read. Intrinsic motivations to read are not considered the same as interest, although interest is one aspect of motivation. For this study, intrinsic motivation refers to being motivated and curious to an activity for its own sake. One aspect of intrinsic motivation is becoming deeply involved in the activity one is doing. This involvement may be called flow (Csikszentmihalyi. 1978), in which one loses track of time and self-awareness when becoming completely involved in an activity such as reading a book. Oldfather's (1992) idea of the continuing impulse to learn, which is characterized by intense involvement, curiosity, and a search for understanding, is a social constructivist notion of intrinsic motivation. Goal orientation generally describes an individual's habitual orientation toward certain goals (e.g. task-oriented versus ego-oriented. Dweck. 1986; Dweck & Legget. 1988; Harter. 1981; Lepper. 1988; Nicholls. 1984; Ryan. 1982). Lepper (1988) describes two central components to a goal orientation conducive to learning: (a) willingness to engage in an activity for its own sake (intrinsic component) and (b) the belief that one is the initiator
of a learning activity and is solely responsible for its results. Deci and Ryan’s (1985) theory of intrinsic motivation states that behavior is based upon psychological needs for self-determination and competence, which corresponds with Lepper. Students who have learning goal orientation also tend to be intrinsically motivated (Wigfield. 1997).

**Interest.** There are three kinds of interest that need to be distinguished in this dissertation, apart from intrinsic motivation to read. **Topic interest** or **personal interest** is unique to the individual, topic specific, long lasting, and exits prior to encountering a particular text (Hidi. 1990; Schiefele. 1992). **Situational interest** is an emotional state aroused by situational stimuli, is common across individuals, short lived, and elicited within a particular context (Krapp, Hidi, & Renninger. 1992; Wade. 1992). Research supports the general conclusion that both individual and situational interest have a positive influence on text comprehension (e.g., Anderson, Mason, & Shirey. 1984; Hidi & Baird. 1988; Renninger. 1988). “**Interestingness**” or **text-based interest** is the way a text or stimulus materials influence cognitive performance across subjects, regardless of individual differences (Hidi & Baird. 1988).

**Conceptual knowledge.** Conceptual knowledge is defined as a systemic or relational understanding of features and elements about a phenomenon. When an individual understands the connections between features, structures, functions, principles, and constructs of a system, they are said to have conceptual understanding. According to Alexander, Schallert, and Hare (1991), students have gained conceptual meaning from text when they can form high-order principles that explain the relationships between the features and factual information they have read.
**Prior knowledge.** Prior knowledge is defined as the knowledge students already possess about the topic, prior to instruction or exposure to the topic. This prior knowledge was used as a controlling variable in this study.

**Purpose of the Study**

The purpose of this study was to examine the relationships between interesting texts and science observation and their effects on intrinsic motivation to read, situational interest, and acquisition of conceptual knowledge by manipulating instructional conditions for these factors. The population of the study was multicultural and large enough to permit generalization among fifth-grade students within the United States. The classrooms and schools used in the study were typical of mainstream classrooms in the sense that a variety of reading abilities were represented, as well as socio-economic conditions of the students involved. The texts used in the study represented ideological sources of expository texts used in a typical fifth-grade classroom.

This dissertation was an experimental intervention that documents that an instructional condition can be produced to yield significant knowledge gains when compared to three other instructional conditions, even when reading achievement and prior knowledge have been accounted for. The four instructional conditions included: (a) the combination of interesting texts and science observation, (b) science observation only, (c) interesting texts only, and (d) the control group, or regular classroom science instruction. Specifically, an interaction between interesting texts and science
observation would be the optimal outcome of the instructional condition with both science observation and interesting texts, hopefully resulting in the most significant gains in conceptual knowledge.

Significance of the Study

This study is significant for many reasons. First, if the anticipated outcomes result, then this study documents that an instructional condition can be produced which creates situational interest and increases students' motivation to read, resulting in significant conceptual knowledge gains about a life science topic. Second, this study may document an important relationship between at least two factors in a classroom context that are conducive to learning: interesting texts and science observation. The combination of interesting texts and science observation may prove to be more powerful in creating situational interest and sustaining intrinsic motivations to read when compared to the other three instructional conditions. Third, the combination of interesting texts and science observation will hopefully yield higher conceptual knowledge gains about a life science topic when compared to the other three instructional conditions. Although there will probably be students in all four groups who gain conceptual knowledge, there will hopefully be more students who gain a deeper level of conceptual knowledge in the interesting texts and science observation treatment condition.

Fourth, if the anticipated outcomes result, the results of this study will speak to the importance of integration of curriculum, in this case literacy and life science. When
curriculum topics are combined with skills and strategies, there may be more coherence to instruction and students are able to make important connections across domains.

Fifth, this study has potential to emphasize the importance of teaching children how to search for information in expository texts. Although specific search strategies will not be taught explicitly in this study, the process of searching for information and processing expository text to gain knowledge is an important skill that results in higher knowledge gains if applied to a task such as this. Finally, school reform and improvement to increase student achievement are paramount goals in most school systems in the United States. This study is anticipated to provide important insight about how to create curiosity and interest in a life science topic, which may motivate children to read and begin to become life-long learners.
CHAPTER II

Review of Literature

Orientation

Chapter I defined the problem to be explored in the study, defined constructs in the study, and established the purpose and significance for this dissertation. The purpose for the present study was to examine the process of gaining conceptual knowledge through reading and science observation, in the domain of life science. Specifically, this process of gaining conceptual knowledge was examined in terms of: (a) science observation, (b) intrinsic motivations for reading in general, and in terms of learning goal orientations, (c) asking questions, (d) searching for information in interesting texts, and (5) expressing conceptual knowledge through writing and drawing. The current study examined the interrelationship of the two independent variables, within the process of gaining conceptual knowledge, and their effects on students' knowledge gain, as well as their intrinsic motivations to read.

Limits of the Literature Review

This dissertation speaks to instructional contexts and has important instructional implications. The study examined two instructional constructs: science observation and the use of interesting texts. The search of the literature was limited to studies that were relevant to elementary-aged students, grades 3-6, related to science learning. The effects of these variables on conceptual knowledge, motivations for reading, question asking.
and motivation for learning a life science topic were reviewed for elementary-aged children. I emphasized review articles and pivotal empirical research studies, due to the large bodies of literature available for each construct.

Chapter Two Overview

This chapter will begin by examining the processes of gaining conceptual understanding from expository text. First, the construct of conceptual knowledge is defined and distinguished from other forms of knowledge. Second, the process of gaining conceptual knowledge is discussed. Third, the importance of classroom instruction to help students gain this knowledge is presented.

Searching for information is a necessary process in gaining conceptual knowledge when multiple texts or sources of information are available. The second topic examined in this chapter is the process of locating information in expository text. This process of search is discussed, based on the current literature. Next, an existing model for searching for information is presented. The three components in this search model for children is discussed, including: questioning, text selection, and integration. Finally, the importance of classroom instruction to teach these search skills is discussed.

Chapter II will continue with the second dependent variable in the study: intrinsic motivation. Specifically, the focus is on goal setting as a motivational strategy for learning from informational text. This is presented in three parts. First, the construct of motivational goals is defined and distinguished from intrinsic motivation and from other strategies for learning. Second, learning goals are distinguished from performance goals.
Finally, three perspectives on how learning goals motivate students in the classroom are discussed.

Long-term motivations for searching during conceptual learning depend upon contexts for learning. One aspect of the classroom context examined in this study is science observation. Chapter II defines the construct of science; and the rationale for science observation in instruction is presented. Lastly, the elements necessary to create a classroom context that enhance motivations for learning are overviewed, based on the current literature.

Long-term motivations for searching also depend upon multiple, interesting texts, especially texts that are interesting or relate to students’ personal interests. The construct of interest is defined in terms of interestingness of text, students’ interest in a topic, and readers’ interest, which all play an important role in this study. Next, the effects of interesting texts, topic interest, and reader interest on conceptual learning are examined. Third, the effect of readers’ interest on time spent reading is explored. Finally, the predicted interaction between science observation and interesting texts on learning is presented. This prediction is followed by the research questions guiding the study.

**Conceptual Knowledge**

A number of authors distinguish between conceptual knowledge and content knowledge and domain knowledge. According to the Alexander et al. (1991) model, conceptual knowledge subsumes content knowledge. Content knowledge is a type of knowledge about the physical, social, or mental world. This kind of knowledge can be
obtained or used in formal or informal ways. For example, content knowledge would include general knowledge about life science. Knowledge about animals and plants is common for most people. But as one studies life science in school, it becomes a more specialized focus of study and moves to the category of domain knowledge. When students study animals and plants that live in different habitats, they are gaining domain knowledge. There needs to be a distinction made between knowledge within subject areas. This dissertation focuses on life science, which is a specific kind of domain knowledge. Distinctions among domain knowledge, subject-matter knowledge, and topic knowledge will be examined next.

**Domain, Subject-Matter, and Topic Knowledge**

Within the content or subject-matter knowledge category are domain knowledge and topic knowledge (Alexander, Kulikowich, & Jetton, 1994). In general, subject-matter knowledge is knowledge specific to a field of study such as chemistry, history, or music. Domain knowledge represents the breadth of that knowledge and includes declarative, procedural, and conditional knowledge relative to the given field. Topic knowledge signifies the depth of subject-matter knowledge and would include subtopics or categories within a domain. For example, in the domain of biology, topics could include cell structure or reproduction. Topic and domain knowledge work together. Topic knowledge relates to domain knowledge in the sense that the more topic knowledge one has, the more domain knowledge they are likely to have (Alexander, et al., in press). There is an important relationship between the emphasis on domain-
specific knowledge and the concern for prior knowledge that is evident in research on
cognitive learning (Schuell, 1986). Both domain-specific, and general, domain-
independent learning strategies (Block, 1985; Glaser, 1984; Sternberg, 1985) are
important in most learning situations (Glaser, 1985; Keil, 1984).

The primary way individuals gain subject-matter knowledge in school is through
text (Chall & Conrad, 1991). Likewise, Tyler and Voss (1982) found that subject-matter
knowledge becomes a dominating factor when processing highly informational texts.
Different kinds of texts place different demands on readers. Readers must invoke the
strategies and conventions appropriate to them (Graesser, Golding, & Long, 1991;
Smagorinsky & Smith, 1992). Alexander, Kulikowich, and Jetton (1994) described the
importance of having subject-matter knowledge and the impact this knowledge has on
both adept and poor readers. Students with more subject-matter knowledge are better
able to process text, and these students continue to gain substantially more domain-
specific knowledge over time. These students who have more domain knowledge or
more topic knowledge, also read more, which creates additional opportunity to gain
subject-matter knowledge. However, the students with limited subject-matter
knowledge are unable to process informational text, and thus, continue to fall further and
further behind.

**Domain knowledge.** In a framework for domain learning, Alexander (in press)
described three distinct stages. These three stages are acclimation, competency, and
proficiency or expertise. Three forces that create movement from one stage to another
are subject-matter knowledge, motivation or personal interest invested, and strategic
knowledge or self-regulation strategies. In the acclimation stage, knowledge is
unorganized or fragmented. Knowledge is largely declarative, and acclimated learners
must rely heavily on their general strategic knowledge.

When students move from acclimation to competency, they have had some
meaningful experiences to gain domain knowledge, are strategic in their processing of
this knowledge, and are motivated to continue learning. Competent learners possess a
more cohesive body of domain knowledge. Competent learners can also distinguish
between relevant and irrelevant information within a domain. The competent learner is
able to build both breadth and depth of knowledge (diSessa. 1989), as well as determine

Proficiency or expertise is the highest stage. This stage requires students to have
high levels of knowledge, strategies, and motivation. "Interest, particularly one's
personal investment in the topic or domain, stimulates depth of processing in the content
and, thus, enhances subject-matter knowledge" (Alexander. Jetton. Kulikowich. &
Woehler. 1994. p. 217). Proficient students' knowledge is principled, and, therefore,
their learning or knowledge seeking is principled-bound. These students understand the
relationships between topics within a domain of study.

Discipline knowledge. In the Alexander et al. (1991) model for conceptual
knowledge, one moves from domain knowledge to discipline knowledge. This
knowledge is subsumed within domain knowledge, yet is more specific in nature.
Discipline knowledge is "extensive academic knowledge . . . [that is] organized around
fundamental principles that define a particular field" (p. 326). A person's knowledge not
only becomes more extensive, but more organized and complete around common principles. Although it takes a long time to develop discipline knowledge, young children can learn how to organize information from text around common principles. When they are able to do this, their level of processing this information is defined as conceptual. Holyoak (1991) states that “expertise in any domain is built around central principles or concepts that give that domain its identity or form. Such principled understanding, which is the hallmark of expertise, can also stimulate the transfer of understanding from one domain or context to another” (p. 35. cf. Alexander, Murphy, & Woods, 1996).

**Conceptual or systemic understanding.** A fourth level of processing is the beginning of building conceptual or systemic understanding. Conceptual knowledge is defined here as a systemic or relational understanding of features and elements about a phenomenon. When an individual understands the connections between features, structures, functions, principles, and constructs of a system, they are said to have “conceptual understanding.” This could include anything from knowledge about the circulatory system in the human body to the life cycle of a barn owl. Students have gained conceptual meaning from text, when they can form high-order principles that explain the relationships between the features and factual information they have read (Alexander et al., 1991). Now that conceptual knowledge has been defined and described, how is it acquired?
Gaining Conceptual Knowledge: The Construction Process

Making meaning from text is a complex process: it involves time and effort. Engagement in reading, the process needed to learn from text, involves both motivation and effective strategies (Guthrie & Wigfield. 1997). To construct knowledge when multiple texts are present, uses the process of searching, comprehending, and integrating information from multiple sources. This search process is dependent on what information students attend to (Reynolds & Shirey. 1988), what information is important and relevant to the task (Alexander, Kulikowich, & Jetton. 1994; Pichert & Anderson. 1977), motivational variables (Pintrich & Schrauben. 1992; Wigfield & Eccles. 1992), the use of cognitive strategies (Pressley. 1990; Pressley, Goodchild, et al.. 1989), self-regulation strategies (Baker & Brown. 1984; Schunk. 1996), and motivations for understanding (Paris & Turner. 1994). Specifically, learning goals (e.g., Ames. 1984; Dweck & Leggett. 1988; Meece & Holt. 1993; Wentzel. 1989) and self-questioning strategies (e.g., Denner & Rickards. 1987; Scardamalia & Bereiter. 1993) enable students to guide their search for information. When students believe they have a real purpose for learning, they participate actively in reading to know. Students are driven to find answers to their questions, to learn about a subject, to increase their existing understanding about a topic of interest, or to explain the world around them. Students' learning goals and questions, in turn, depend on science observations.

Children are interested in learning about the world around them. Children learn more about study topics that are relevant to their lives, and mean something “in their world” (e.g., a frog). Science observations, involving multi-sensory experiences with
concrete objects. are intriguing (Linn. 1980; Linn & Muilenburg. 1996; Roth. Anderson.
& Smith. 1987; Tobin. 1990). For example, imagine a classroom situation where a live frog is in the room. When children interact with a live animal. (e.g., a frog). their interest is piqued. How far can it jump? When does it croak? Look at its eyes! What does it eat? An encounter with a live animal creates an opportunity for children's natural curiosity to be unleashed. As children begin to interact with the frog, they begin to wonder and think. The process of questioning and discussion about frogs begins. These questions lead to learning goals. Students want to learn about the life cycle of frogs, their habitats, their survival tactics, their features, and their characteristics. These goals set the stage for gaining knowledge of concepts. Students are then ready to search for information in books; they want to read about frogs. Constructing knowledge concepts from text occurs when the search for information answers the learners' questions and helps them achieve their learning goals. There are different perspectives on how these knowledge concepts are constructed (Guthrie et al.. in press).

Restructuring perspective. One way students construct knowledge is through the process of restructuring existing knowledge with new information (Carey. 1985; Chinn & Brewer. 1993; Perkins & Simmons. 1988; Pintrich. Marx. & Boyle. 1993; Strike & Posner. 1985; Vosniadou. 1994). Conceptual change is a modification or an altering of previous knowledge about a topic. Strike and Posner (1985) suggested specific steps that lead to conceptual change. The first step toward conceptual change is when an individual is dissatisfied with their current idea or perception. Secondly, the alternative concept or idea must be meaningful to this individual. Third, the alternative must be
understandable and plausible, meaning that the alternative choice is possible. Finally, the alternative choice must be fruitful, or able to be extended to produce further ideas. According to Strike and Posner an individual has experienced conceptual change when they have gone through this cognitive process.

In addition to the cognitive process of conceptual change are other factors that may influence this change. Pintrich, Marx, and Boyle (1993) suggested that conceptual change can be influenced by personal, motivational, social, and historical processes. They defined learning as the interaction that takes place between one's experience and one's current conceptions and ideas. Individual motivational factors also have an impact. A person's choice of task, one's engagement while performing the task, and one's willingness to persist at the task also determines conceptual change. Some concepts also appear more resistant to change, in part because everyday experiences can actually fortify weak or misleading conceptions. In addition, an individual's interest in a topic may lead to the desire to learn more about it (Hidi, 1990; Pintrich et al., 1993; Tobias, 1994).

In some science domains, such as chemistry, physics, and biology, conceptual change can occur when a student's previous notion of a theory is challenged. In a study involving students in grades 1, 3, and 5, Vosniadou (1994) found that children's misconceptions about the shape of the earth were difficult to change. She found that children restructure their knowledge of the earth's shape over time. Children were asked to represent their conception of the shape of the earth in a drawing. Later, students were asked to answer questions about their picture and explain their representation. Most of
the younger students held a dual theory of the earth. They believed that the earth is round, but if you walked to the edge of it you can fall off. By third grade, nearly one-third of the students believed the earth is a sphere. Many of the students held to the belief that the earth is flat. Two-thirds of the fifth-grade students believed the earth was a sphere and people lived on all sides of it. Students were consistent with their explanations. Conceptual learning came when students revised their explanations of their understanding about the earth's shape. The specific facts and features of the concept did not change much, but the explanation changed substantially. This study illustrated the fact that it took time to change children's misconceptions of the earth's shape.

The role of analogical thinking in teaching and learning science has received increasing attention in recent years (Lawson, 1994; Roth, 1990). Chinn and Brewer (1993) stated that anomalous data are essential for knowledge acquisition in science domains where theory and students' preconceived ideas are contradictory. In the life science domain, however, misconceptions are not prevalent among young children, or they may be more difficult to identify. Therefore, issues of anomalous data and conceptual change based on contradicting theories are not the focus of this dissertation. Instead, the focus is on the process young children go through to gain conceptual understanding, based on their prior knowledge and experience.

**Enrichment perspective.** A second way of constructing knowledge is through enrichment of mental structures from a constructivist perspective (Glynn, Yeaney, & Britton, 1991). For example, in a study involving sixth graders, White (1993) used a computer program to help students create a conceptual model that would explain their
reasoning about how forces affect the motion of objects. The students had to apply their model in making predictions, solving problems, and generating explanations. Students used a computer program called ThinkerTools that helped them learn through simulation of motion and activities that focused on students' inquiries. The results of the study concluded that these students were able to solve problems better than high school students with traditional instruction. The emphasis on the ThinkerTools approach focused on understanding concepts and causal relationships and on linking abstract formalisms with conceptual knowledge and real-world phenomena. Students designed representations and derived laws and principles that operated on those representations, in order to make inferences about a system's behavior. Through this process, students acquired powerful conceptual models of domain phenomena that enabled predictions and explanations. They also acquired metaknowledge about the form of scientific models and the process of constructing them.

In a study involving sixth and seventh graders, Smith, Snir, and Grosslight (1992) used conceptual models to help students gain conceptual understanding about weight and density using computers and explorations of real-world phenomena. Students used hands-on activities replete with cylinders, corks, wood, clay, brass cubes, pencils, rulers, scales, and various containers to hold and measure liquids (e.g., oil and water). After time to explore and experiment with tools and liquids, students were asked to develop a mental model on the computer that would explain the differences between weight and density. Students had to order a set of cubes and cylinders by weight and then explain the basis of their ordering. They also had to explain why objects of different
materials could have the same weight. The experimentation of hands-on activities to build explanations of mental models facilitated students' ability to understand the relationship between weight and density. This work has focused heavily on the importance of explanation as a means to enrich and augment one's understanding. From an instructional standpoint, it also has the effect of externalizing one's understanding.

In another study, Chi, DeLeeuw, Chiu, and LaVancher (1994), used mental models and explanations to enhance students' conceptual understanding about the biology of the human heart and the circulatory system. These models contained a large number of features, structures, and behaviors, as well as a systemic sense of how the heart functions. Conceptual learning was associated with an increased number of features, as well as connections made between functions of the heart and the degree of accuracy in representing this complex system. In addition to the mental models students constructed, Chi et al. found that students who were prompted to explain their ideas and to expand upon questions based on text, gained deeper conceptual knowledge from text than those who were not prompted to explain.

Brown (1988) stated that deep understanding is most likely to occur when students are required to explain, elaborate, or defend their positions to others. This burden of explanation is often the push needed to make students evaluate, integrate, and elaborate knowledge in new ways (Hatano & Inagaki, 1987). Likewise, in a study involving fifth graders, Baxter, Elder, and Glaser (1996) found that quality of explanations was enhanced between those who reasoned well and integrated their knowledge of circuits and those who did not. In addition, adequacy of problem
representation. appropriateness of solution strategies, and frequency and flexibility of self-monitoring indicated effective learning of the subject matter. Consistent with this perspective, Mayer (1992) stated that conceptual knowledge can be described as a runnable model. His studies showed that conceptual knowledge of a system such as a bicycle pump consists of knowledge of the parts of the bike, their actions, and the principles that govern those actions, such as motion, friction, and resistance. Students whose knowledge was based on the principles of the system were able to answer higher-level questions and solve problems better than students who did not have this systemic mental model.

The importance of understanding how a system works is also supported by diSessa (1993) with regard to physics. He claimed that understanding how a system works allows students to develop scientific knowledge based on the general principles of that system. As previously stated, Alexander et al. (1991) concluded that students who are most knowledgeable in a subject, organize their understanding based on fundamental principles. These principles are associated with rules, evidence, and procedures for gathering and testing evidence. Guthrie et al. (in press) also espoused explanation as a means of enrichment. Their studies concluded that third- and fifth-grade students gained deeper conceptual knowledge when they could explain their knowledge (e.g., writing and drawing) about differences between two biomes in the domain of life science. Students who could make connections between features, structures, and functions of the plants and animals in these biomes, and based this understanding on common principles to both systems (e.g., availability of water, survival), gained the most conceptual
learning. diSessa (1993), Alexander et al. (1991), and Guthrie et al. (in press) emphasized the perspective that conceptual learning consists of generalizations that encompass specific features, structures, and functions.

As a summary, based on an extensive review of research, Glynn and Duit (1995) proposed a model of how students gain conceptual knowledge from reading. In their model, students learn concepts quickly and thoroughly when five conditions are provided, including the following:

1. Existing knowledge is activated.

2. New information and educational experiences are related to existing knowledge.

3. Intrinsic motivation is developed.

4. New knowledge is constructed.

5. New knowledge is applied, evaluated, and revised.

Prior knowledge is the foundation for constructing new knowledge and understanding (Dole, Duffy, Roehler, & Pearson. 1991; Symons & Pressley. 1993; Yochum. 1991). Students also understand a new text when they have existing knowledge about the topic (Dole. Valencia. Greer. & Wardrop. 1991; Symons & Pressley. 1993; Yochum. 1991). As students encounter new information, they organize and construct it into understanding. Prior knowledge, as well as the organizational structure of a text are important facts that influence childrens’ text comprehension (Anderson & Pearson. 1984; McGee. 1982; Taylor. 1980). New knowledge may come in the form of text from magazines, trade books, or textbooks. New information may
also be generated through hands-on experiences involving the senses. Students acquire new information when they gain experience through seeing, smelling, feeling, seeing, and hearing. These sensory experiences are often used to teach science concepts, but they are seldom used to enhance reading development. Although it seems wise to provide students with both ways of acquiring new knowledge, both are seldom taught in tandem. Reading teachers rarely have hands-on interactions to support reading and science teachers avoid textbooks as a basis of learning science concepts, not to mention multiple sources of text (Guthrie & Anderson, in press).

The Importance of Instruction in Constructing Conceptual Knowledge

Constructing knowledge from text is not easily achieved without proper instruction and student effort. Concept learning is considered a complex type of learning (Gagné, 1962). Learning concepts from text is strongly facilitated by complex cognitive strategies. In the presence of multiple texts, students need to search for information and integrate it with their prior knowledge. It is reasonable that these search strategies need to be taught explicitly within a classroom context conducive to student-centered learning. Effective instruction for search is consistent with cognitive conceptions of learning which stress the active, constructive, cumulative, and goal-oriented natures of learning (Schuell, 1986, 1988), as well as autonomous, self-directed learning (Corno, 1987; Thomas & Rohwer, 1986).

When learning how to search is centered around students and their needs, students may be more motivated to learn and to understand. Creating a classroom
context that fosters curiosity and the need to know is facilitated by meaningful activities (e.g., science observation of a cricket). In addition, these activities are centered around a conceptual theme (e.g., animal habitats) (Guthrie et al., in press). Both environmental factors and factors internal to the student contribute to learning in an interactive way (Brown, Bransford, Ferrara, & Campione, 1983; Roth, 1994).

Hands-on, science observation may initiate student interest, forming a foundation on which to build conceptual knowledge. Knowledge, however, is not easily constructed from a simple science observation. It is plausible that hands-on, science observation, although motivating and exciting for students, may not inform without the benefit of text or teacher knowledge. The ability to explain a phenomenon around a concrete object is often facilitated by the ability to gain knowledge from text (Chi et al., 1994), or from a teacher’s explanation. Constructing knowledge from text is a higher-order cognitive process. Students do not typically learn these strategies incidentally. The proper strategies for gaining knowledge from text may be facilitated through explicit instruction within relevant learning tasks that require employment of these search strategies. Students need practice using search strategies to learn them. “Effective learning involves a well-organized, efficient core of internal knowledge and a repertoire of domain-specific and general strategies to activate, manage, and evaluate the external resources that will successfully augment and extend what one knows independently” (Alexander & Knight, 1993, p. 236).

Current criticisms of traditional classroom instruction revolve around the lack of relevance of instruction for the student, the lock-step way in which many teacher
approach coverage of content, the heavy emphasis on declarative knowledge, the
teacher-centeredness of many classrooms, and the artificial and abstract nature of school
learning (Palinscar, 1991). These criticisms have been particularly true for students
classified as at-risk, since they typically work alone on lower-level materials often
unrelated to their lives (cf. Alexander & Knight, 1993, Palinscar, 1991). Teachers
therefore, need to create classroom environments that place skill instruction within
relevant tasks as a priority. Assessment of learning also needs to underscore
understanding and connections between factual information rather than wholly
memorization of facts (APA Learner-Centered Psychological Principles. Alexander &
Knight, 1993). Traditional conceptions of learning have employed simple tasks that
involve memorization more than comprehension (Schuell, 1986).

I expect that in addition to the need for improved and more explicit strategy
instruction, there is also a need for more resources, namely multiple texts. It is
reasonable to assert that multiple resources are needed to teach children how to gain
conceptual knowledge from text. Students need a variety of trade books, on a variety of
reading levels, to support different reading abilities. Encyclopedias, trade books,
informational books, magazines, guide books, maps, and other supplements on a variety
of topics need to be accessible to students to support their interests and wonder. It
seems that when classrooms are well equipped with resources, teachers may be more
prepared to facilitate students' learning and students are free to explore answers to their
questions by reading. Student questions lead to the desire to find answers (Commeyras
& Sumner, 1995). Searching for knowledge is a life long skill that can empower children
to become architects of their own learning.

**Question Asking: Searching Informational Texts to Gain Conceptual Knowledge**

Conceptual learning is facilitated by effective strategies for search. Engaged learners are motivated to understand and explain the world around them (Guthrie et al., in press). As they explore their environment, they may become involved in a process of searching for information. Searching for information is a frequent task for children in school. Teachers often expect students to search for answers to questions, seek information on subjects of interest, and look for evidence to support claims or ideas. The importance of searching for information is underscored by the fact that this skill is assessed on standardized tests and taught in reading basal programs (Armbruster & Armstrong, 1993). For the purpose of clarification in this study, locating information may be the process of gathering facts which may or may not be attended to (Reynolds & Shirey, 1988), or processed into knowledge. On the other hand, searching for knowledge would indicate a deliberate process of organizing facts or information to gain or increase conceptual knowledge and understanding. What is involved in the process of locating information? How is this information processed into knowledge, namely conceptual understanding?

**The Process of Locating Information**

The process of searching for information in a classroom context is complex. Effective knowledge seeking depends on a range of cognitive and motivational variables.
It is plausible that successful searching is dependent on what information students attend to (Reynolds & Shirey, 1988). What information is perceived as important and relevant to the task (Alexander, Kulikowich, & Schulze, 1994), motivational variables (Pintrich & Schrauben, 1992; Wigfield & Eccles, 1992), the use of cognitive strategies (Pressley, 1990; Pressley & Afflerbach, 1995), self-regulation processes (Baker & Brown, 1984; Schunk, 1996), and self-questioning strategies (Denner & Rikards, 1987; Scardamalia & Bereiter, 1993).

Searching for information from text is a type of strategic reading (Guthrie & Mosenthal, 1987) in which students engage in the following processes: (a) they have a question, a purpose, or a goal for reading, which defines the task; (b) they analyze the task, considering all the factors that will affect it; (c) they choose strategies that will help them achieve their goal; (d) they monitor their comprehension and learning; and (e) they change their strategies, if necessary, to achieve their goal (Dole et al., 1991; Wade, 1992). Alexander and Judy (1988) defined strategies to be "goal-directed procedures that are planfully or intentionally evoked either prior to, during, or after the performance of a task. As such, strategies aid in the regulation, execution, or evaluation of that task" (pp. 376).

Researchers who have studied strategy use have typically looked at search strategies for locating, outlining, and retrieving information and how this strategy use contributes to conceptual understanding (Guthrie et al., in press; Pintrich & DeGroot, 1990). Guthrie, Britten, and Barker (1991) found that students with efficient or exhaustive strategies showed greater awareness of process in their reports than students
with erratic strategy use. Other researchers have studied the role of interest and how interest contributes to conceptual understanding (Alexander & Jetton, 1996; Alexander, Jetton, & Kulikowich, 1995; Hidi, 1990; Reed & Schallert, 1993; Schiefele, 1992; Schraw et al., 1995). There are also studies confirming that both of these elements contribute to understanding (Anderson & Guthrie, 1997; Guthrie et al., 1991; Mosenthal, 1985; Stanovich & Cunningham, 1993).

Literacy engagement with multiple informational texts is an integrated conceptual learning task (Mosenthal, 1985). For students to be able to do this task well, they must first be able to search and retrieve the right amount of the correct and necessary information. In addition, students must be able to comprehend and integrate the multiple ideas encountered in texts. Successful learning is also facilitated by one's ability to compare and contrast the main elements of information, combine ideas, eliminate irrelevant information, and then synthesize this information into deep understanding (Rukavina & Daneman, 1996). Ultimately, students must be able to express this understanding through writing, speaking, or through graphic representations.

Previous research has examined a cognitive model of how people retrieve information from complex documents (Guthrie, 1988; Guthrie & Mosenthal, 1985). Initial studies of the model described the processes that are involved in the search of tables, schedules, and graphs (Guthrie & Kirsch, 1987; Kirsch & Mosenthal, 1990; Mosenthal, 1996). Other studies have shown that the model accounts for searching for information in textbook chapters (Byrnes & Guthrie, 1993; Dreher & Guthrie, 1990).
The model can be described in terms of the following four components: (a) goal formation, in which the goal or question for the task is formed and reformed by the searcher; (b) category selection, in which the major categories of information within the document are identified and important categories that are relevant to the goal are chosen; (c) information extraction, in which details within a relevant category are thoroughly identified; and (d) integration, in which new information is combined with prior knowledge (Guthrie et al., 1991).

The initial model described the processes of locating specific information. For instance, students may be asked to locate the month with the most rainfall on a bar graph, or find the location of a city on a map. Such tasks have been termed "local searches." Another form of search is "global search," which occurs when all aspects of the document must be processed or examined to formulate a general conclusion or generalization. To accommodate global search, Guthrie, Weber, and Kimmerly (1993) expanded the model to include the process of abstraction. Abstraction refers to forming relationships among disparate processes of information from different categories of a document or text. The addition of the abstraction process enabled the model to account for not only local searches, but global searches as well. Previous studies of search have usually been limited in two ways. First, they have included college students or adults, and second, they have emphasized a single document.

Recently, Anderson and Guthrie (1997) combined elements from the existing search model to apply to elementary age children in multi-text, complex search tasks (Mosenthal, 1996). Complex search tasks are defined by Mosenthal (1985) as the
following: (a) the question makes a comparison: (b) the task includes multiple sources of text: (c) there are multiple categories within the multiple texts: and (d) there are distractions in the possible text selections. To understand the process of searching for information, a closer look at the three components in the Anderson and Guthrie (1997) model follows.

Three Components in the Search Model for Children

Questioning. The first component, questioning, is what defines the task and gives purpose to the search. In their study of a multi-text, complex task, Anderson and Guthrie (1997) posed a question that served as the goal for the task. This question enabled students to perform the goal formation component in the Guthrie et al. (1993) model. There is little research to inform us about the questions students ask to serve as goals for locating information (Armbruster & Armstrong, 1993). One source of goals is teacher or textbook questioning. However, teachers may also ask questions that generate thinking without necessarily eliciting a response (Armbruster, Anderson, Armstrong, Wise, Janisch, & Meyer, 1991), and questions in textbooks often serve to activate prior knowledge, apply a principle, set a purpose for reading, or stimulate critical thinking rather than initiate searches (Armbruster & Armstrong, 1993). In the present study, it was reasoned that a teacher-posed question to guide this complex search would be a familiar task. In Concept-Oriented Reading Instruction (CORI), classroom teachers design tasks that stimulate students' questioning through science observations. Students' personal questions serve as the goal for searching for
information (Guthrie et al., in press).

It is plausible that questioning leads to search and improves understanding. Questions, whether generated by the teacher, student, or textbook, may improve comprehension and recall of text (King, 1994). When students are asked to inspect text to identify main ideas, and to integrate parts together, they may process text more thoroughly (Craig & Lockhart, 1972). Wong (1985) stated that self-questioning improves performance due to more active processing of text. This hypothesis agrees with the Wittrock’s (1974) model of generative learning. Denner and Rickards (1987) also agreed that students’ performance is improved when students are aware of how different text structures alter their processing or affect their performance.

In a study to investigate student questioning and better processing of text, Denner and Rickards (1987) compared student-generated to experimenter-provided questions to text recall. The participants were students in grades 5, 8, and 11. Denner and Richards predicted that the older students (e.g., eleventh-graders) should generate high-level, conceptual questions (e.g., represented by relationships or systems), and younger students (e.g., fifth-graders) should produce low-level, factual questions (e.g., represented by features or functions). The provided questions for all grade levels were high-level, conceptual questions. All students read a passage about a fictitious African nation. There were three treatment conditions: students were randomly assigned to a group. Students in the first treatment group were asked to read the passage and answer the questions provided at the end of each paragraph. Students in this group were allowed to refer back to the associated text paragraph when answering the question.
Students in the second treatment group were asked to read the passage, to generate a question after each paragraph that would help them remember the important information they read, and then write each question down. Students in the third treatment condition were asked only to read the passage and to pay attention to the important information. This study found that students who received provided questions or who generated their own questions recalled significantly more factual information than the students who read the passage without questions. Also, provided conceptual questions produced significantly more recall of concepts than no questions.

This study has relevance to the current dissertation study, because the question in the dissertation task served as a goal for the task. Without teacher-provided or student-generated questions, the search for information may be unfocused, perhaps leading to less knowledge gains and conceptual understanding. In the Denner and Rickards (1987) study, students who were more aware of their ability to self-generate questions and the effect this would have on their recall. "shifted their focus during reading from merely 'selecting' information to 'organizing' facts in relation to ideas" (p. 135). This study also demonstrated that provided questions can enhance the performance of young readers and that young readers may benefit from explicit prompts (Brown & Smiley, 1977; O'Flahavan, Hartman, & Pearson, 1988; Rickards & Hatcher, 1978; Swenson & Kulhavy, 1974).

In a study focusing on the ability to ask and recognize important questions, Scardamalia and Bereiter (1993) investigated elementary children in terms of text-based and knowledge-based questioning. Text-based questions are prompted by text and are
usually about the text. They can range from high-level analytical questions to low-level questions about word meanings (Bereiter & Scardamalia, 1989). Knowledge-based questions, on the other hand, arise from a child's interest or from their effort to make sense of the world. These questions fill a gap between the students' knowledge and their desire to learn more. These two kinds of questioning (e.g., text-based vs. knowledge-based) can produce qualitatively different kinds of questions, which ultimately drive and direct the learning process for students (Scardamalia & Bereiter, 1993).

The data for the study came from fifth- and sixth-grade student-generated questions about endangered species. In the text-based condition, students chose reference materials on endangered species and scanned them before generating questions to guide their further study. In the knowledge-based condition, students were presented with the topic of endangered species and were asked to write questions reflecting what they wondered about or needed to know to increase their knowledge of endangered species. Students began generating questions immediately; they were told not to worry if they could answer the questions. The sets of questions from both conditions, along with questions chosen from published curriculum materials, were randomly intermixed. All questions were rated according to: (a) complexity of search required to answer the question, (b) how interesting the question was to the rater, (c) the extent to which the question called for a factual response versus an explanation, and (d) how much pursuit of the question could be expected to contribute to learning. Results indicated that questions generated under the knowledge-based condition received the highest ratings on all four scales. Only 4% of the questions produced under the text-based condition were
judged as likely to significantly add knowledge or to advance conceptual understanding. In comparison, 46% of the questions generated in the knowledge-based condition received this rating. In a subsequent study, Scardamalia and Bereiter (1993) concluded that when children ask questions in advance of studying a topic, they adjust the kinds of questions they ask according to their level of knowledge. If children already have a basic understanding of the topic, they tend to ask questions that will extend their conceptual understanding.

These studies reinforce the importance of questioning as a basis for extending knowledge. Students' questions serve as the springboard for searching for information and gaining knowledge on a topic. Students' prior knowledge of a topic can affect search successes and the extraction of information (Symons & Pressley, 1993). Knowledge-based questions, coupled with a multi-text environment as resources are important to gaining deeper conceptual knowledge. Once students have a question, they must first be able to select appropriate information from multiple sources of text, and then organize or integrate this information into understanding (Denner & Rickards, 1987).

Text selection. The second component of the Anderson and Guthrie (1997) model, text selection, is comparable to category selection in the Guthrie et al. (1993) model. In a multi-text search task, text selection consists of the following procedures: (a) overviewing the organizational structure of texts (e.g., sections in a packet or booklet); (b) judging individual sections to see which ones are relevant to answer the question; (c) identifying relevant, and discriminating relevant from distracting sections of
text: and (d) recording which sections are relevant to the task (Anderson & Guthrie, 1997).

In one study, Guthrie et al. (in press) gave a one-week performance assessment to students in grades 3 and 5 to assess their conceptual knowledge about a life science topic. Students were asked to explain the differences between ponds and deserts. Students' first explanation of these differences was based wholly on their prior knowledge about these two biomes. Next, students were asked to search for information about ponds and deserts. Students were given a booklet containing 14 separate sections of informational text. The goal was for the students to gather and organize enough information so they could explain the differences between ponds and deserts.

The booklet was developed to contain more or less relevant material. Specifically, ten of these sections had relevant information about ponds and deserts (e.g., five sections were about ponds; five sections were about deserts). The other four sections contained information that was not directly relevant to the goal (e.g., information about oceans, forests, and cities). The information contained within the booklet varied in terms of specificity and topics. Students freely chose which sections to read. Some students alternated between biomes and topics (e.g., life in a pond; life in a desert; animals in the pond; animals in the desert). Other students focused more on one biome or topic. Students had ample time to read and gather information, and recorded information they found in search logs. Students in the treatment condition were taught how to search for information with multiple sources of text. These students performed significantly higher in terms of text selection than the control group. This ability to
search and select relevant information positively affected students' ability to gain deeper conceptual understanding as measured in the posttest assessment of conceptual knowledge (Anderson & Guthrie, 1997: Guthrie et al., in press). Once students select the appropriate text to search, they need to extract and integrate the information that will help them answer their question (Armbruster & Armstrong, 1993).

**Comprehend and integrate.** The third component in the Anderson and Guthrie (1997) model, *comprehend and integrate*, combines the elements of information extraction, integration, and abstraction from the Guthrie et al. (1993) model for search. Comprehend and integrate is defined as: (a) finding relevant facts, (b) reading and understanding the information, (c) connecting new information to prior knowledge, and (d) integrating this information among other texts. Not only were students in the Guthrie et. al. (in press) study required to select relevant information, but they also needed to read and understand this information. Students who were able to integrate information from sections of the packet (e.g., animals in the desert: desert climate: and desert animal adaptations), were the students who gained the most conceptual understanding. These students could express their conceptual knowledge through writing and drawing.

In a follow-up study, Anderson and Guthrie (1997) examined 62 randomly chosen students' search logs from the 1995 CORI database. Students were randomly and equally selected from each grade level (e.g., grades 3 and 5) and type of instruction (e.g., CORI and traditional). They found two semi-independent components of search: text selection and comprehend and integrate. Component processes in a search are
defined here as components that contribute semi-independently (e.g., in a related way) to the strategy. One can possess several of these component processes. One student may possess some, but not all of the process. Components do not necessarily correlate highly with each other. These two search components predicted outcomes of reading and instruction separately. Only half of the students were provided instruction in searching for information, which included forming goals, selecting texts, comprehending and integrating, and forming abstractions. The instruction in searching for information increased students' ability in text selection after accounting for the role of prior knowledge. However, instruction did not increase the students' level of comprehension and integrating after accounting for the role of prior knowledge. Because instruction for searching differentially influenced these two components of search, it was inferred that the components did not respond to intervention in the same way. Consequently, based on the dual criteria that the components predicted acquisition of conceptual knowledge differently, and the components were predicted by instructional intervention differently: the components appeared to be semi-independent.

The more specific the search goal, the less information extraction and integration are necessary. Conversely, as search goals become more general, students will most likely need to extract and integrate more information (Armbruster & Armstrong, 1993). Multiple sources of text provide students with more opportunities to integrate and extract the kinds of information they need to answer questions in a complex search, or global search tasks. These search strategies need to be taught, since most children do not naturally know how to find the information they need (Armbruster & Armstrong.
The Importance of Instruction in Searching for Knowledge and Generating Questions

Searching for knowledge and generating questions as goals for search are processes that can be taught explicitly to children. The processes of generating questions, selecting relevant text from multiple sources of texts, and then integrating and synthesizing the information extracted into something meaningful is no easy task. Results from standardized tests and research suggests that elementary children have difficulty locating information, especially with general goals and informational text. One reason children are not adept at locating information is because they have not been taught how to do so (Armbruster & Armstrong, 1993).

In most classrooms, reading instruction is heavily influenced by basal reading programs (Anderson, Hiebert, Scott, & Wilkinson, 1985), which tend to focus narrowly on simple texts and tasks. The “search” aspect found in basal programs tends to focus on the “text selection” aspect of search. Students are taught how to find discrete pieces of information in single-text documents (Dreher, 1993; Dreher & Guthrie, 1990; Dreher & Sammons, 1994). Students may be taught search subskills such as alphabetical order, parts of a book (e.g., table of contents, index, glossary), and reference materials (e.g., dictionary, encyclopedia, atlas, maps) (Armbruster & Armstrong, 1993). Commonly, these skills may be taught in isolation and children are not given ample time to meaningfully utilize these skills. Instruction tends not to focus on direct or explicit instruction, but rather on practice and assessment of skills.
(Armbruster & Gudbrandsen, 1986; Durkin, 1981). This research supports the claim that students are not taught the full process of searching for information in text.

Secondly, children may not be adept at searching for information because they do not get adequate time to practice reading in general, especially the kind of reading necessary in locating information in search tasks. Reported research that shows that students appear to spend little time each week reading for school or for pleasure (Armbruster & Armstrong, 1993; Langer. Applebee. Mullis. & Foertsch. 1990); elementary students engage in silent, independent reading only 6% of total class time (Goodlad. 1984). Other research estimates that only 7-8 minutes per day is spent reading in school (Anderson et al., 1985). Out of the small amount of time spent reading, very little of this reading is informational text (Cole et al., 1991). Students spend most of their time reading fictional stories, poems, and plays (Flood & Lapp, 1990). When students do learn about nonfiction topics, they seldom learn the content from textbooks. They rely instead on their teachers' knowledge and presentation of information through discussions, lectures, films, and hands-on activities (Armbruster et al., 1991; Goodlad. 1984; Stodolsky. 1989).

In their review article, Armbruster and Armstrong (1993) made two recommendations to teachers on how to help children become better at searching for information in text. Their first recommendation was that explicit, systematic instruction for locating information should be provided for children beginning in the first grade. The instruction should include the full process of searching for information (Dreher. 1992; Guthrie & Mosenthal. 1987), including instruction about questioning and goal
formation, text selection, comprehension, and integration. Students should be taught through direct and explicit instruction with teacher and peer modeling, lots of practice, and scaffolding (Vygotsky, 1978). Armbruster and Armstrong's (1993) second recommendation was to use more informational text during teaching. Although primary evidence suggests that instruction in searching for information increases children's search performance (Guthrie et al., in press), we lack information about whether instruction increases both the text selection and comprehend and integrate components that were hypothesized to be important (Anderson & Guthrie, 1997).

It is reasonable that instruction also can include teaching children how to generate questions. Since questions can guide the search for answers, it would seem reasonable to teach children about different kinds of questions (e.g., text-based vs. knowledge-based) on different levels of thinking (e.g., conceptual vs. factual). Scardamalia and Bereiter (1986) and Garcia and Pearson (1990) suggested that question generation is one component of teaching students higher-order thinking skills. Question generation is an important strategy in fostering comprehension (Palincsar & Brown, 1984) and self-regulation. Students are required to focus on the main ideas of the content and simultaneously become metacognitive about their comprehension (Palincsar & Brown, 1984; Wong, 1985).

In a review of strategy instruction, Rosenshine, Meister, and Chapman (1996) examined 26 intervention studies on teaching children to generate questions as a way to improve their comprehension. The cognitive strategy of questioning is referred to as a comprehension-fostering strategy (Collins, Brown, & Newman, 1990; Palincsar &
Brown. 1984). Denner and Rickard (1987) focused their earlier research on the importance of questioning, whether student or teacher generated, in the recall of important information in text. They found that questioning does lead to better recall when compared to just reading text. Rosenshine et al.'s study differentiated between student versus teacher generated questioning, which suggests that students may become more involved in reading when they are posing and answering their own questions rather than responding to text or teacher questions. Developing questions may require students to play an active, introductory role in the learning process (Collins et al., 1990; King, 1994; O'Flahavan et al., 1988; Palincsar & Brown, 1984; Singer, 1978). Teaching students to ask questions may also help them become more aware of important parts in a text, helping them monitor their own reading comprehension (Wong, 1985).

Rosenshine et al. (1996) found that most studies used traditional procedures to teach a strategy for generating questions. These procedures included teacher presentation, teacher modeling, and teacher guidance of student practice. Many studies taught question generation as one of four strategies to be taught and practiced within the context of reciprocal teaching (Palincsar & Brown, 1984). Some of the major instructional elements found in these studies include: (a) providing procedural prompts specific to the strategy being taught, (b) providing models of appropriate responses; (c) anticipating potential problems, (d) regulating the difficulty of the material, (e) guiding student practice, (f) providing feedback and corrections, and (g) assessing student mastery. Question generation can be both a cognitive strategy and a goal for learning that may lead to locating information in text. Searching for information is also seems
dependent upon motivational goals for learning (Wigfield & Guthrie. 1997).

Teaching children to search for information to satisfy their questions is an important step in gaining conceptual knowledge. It seems reasonable that in order for this search to be successful, students need to be motivated to search for answers.

**Intrinsic Motivations for Reading**

Intrinsic motivation refers to students' enjoyment of the activity itself. Extrinsic motivation refers to being motivated in an activity as a means to an end, such as getting good grades or receiving a reward (Deci & Ryan. 1985; Harter. 1981). Students' intrinsic motivation to learn about the things they wonder about contributes to deep understanding of concepts (Guthrie. 1996). Interest in a topic is related to intrinsic motivation. Interest enhances the amount, depth, and fullness of conceptual learning from a text about that topic (Alexander, Kulikowich, & Jetton. 1994). Secondly, intrinsic motivations such as involvement, curiosity, and social interaction leads students to understand the substance deeply and to use their new knowledge to solve problems in the content area (Guthrie et al., in press). However, interest is specific to a topic such as dinosaurs, whereas motivation is broader. For example, intrinsic motivations are related to students' use of cognitive strategies for informational text (Guthrie et al., in press). Students are engaged in the learning process when they are both strategic and motivated (Guthrie & Wigfield. 1997).

This process of engagement can be influenced by classroom contexts (Guthrie & Alao. 1997). In this study, intrinsic motivational constructs are defined in terms of
theories of goal orientations, beliefs, and values (Wigfield, 1997). These goals, beliefs, and values are associated with children's performance in school, their choice of activities, and how well they persist at these activities, which are three important indicators of motivation (Eccles et al., in press; Graham & Weiner, 1996; Pintrich & Schunk, 1996; Wigfield, 1997). Students' engagement in reading is facilitated when they are intrinsically motivated and can make their reading personal and meaningful to them (Wigfield, 1997). For this dissertation, goal orientations are included as a motivation for reading in the sense that students' goals set the purpose for reading for information. Students who have learning as their goal, are usually intrinsically motivated (Wigfield, 1997).

Motivation as Goals for Reading

Some motivational theorists believe that motivational constructs vary across domains of learning and should be studied at that level (Wigfield, 1997). Some motivation researchers have focused on children's motivations to achieve in general, as opposed to achievement within a domain-specific area (Dweck & Leggett, 1988; Nicholls, 1979). Within the context of this study, the construct of motivation in terms of goal orientations is domain specific to reading, and subject-matter specific to life science, or both. Goals are defined here as a reason, or as a purpose, for learning about the life cycles and adaptations of crabs and turtles. These specific animals have certain physical characteristics, survival tactics, adaptations, life cycles, and reproduction features that help them live and grow in their respective environments. Students need a reason to want to study and learn more about these animals. Science observation may spark
students' interest and increase their awareness about crabs and turtles. This alone will not inform students. Reading and learning about crabs and turtles on a conceptual level may be facilitated by intrinsic motivations to read and learning as a goal. The different kinds of goal orientations will be discussed next.

**Learning goals.** Dweck and Leggett (1988) defined learning goals (e.g., mastery orientation) as the seeking of challenging tasks and the maintenance of effective striving under failure. Students with learning goals choose learning tasks that are challenging. These students are concerned with their own progress: they want to learn. Students with learning goals tend to choose activities or learning tasks that are interesting to them, even if they may not feel competent. Because their goal is to learn, students with learning goals persist longer at their learning task, even if it requires effort and time (Ames, 1992; Ames & Ames, 1989; Dweck & Leggett, 1988; Nicholls, 1979). In fact, students with this goal orientation for learning want to increase their competence or develop new skills. Challenges and obstacles are viewed as a natural part of the learning process, and these students continue to overcome challenges in spite of failures or setbacks (Dweck & Leggett, 1988). Students with learning goals tend to be intrinsically motivated in terms of challenge, curiosity, and involvement in the task (Wigfield, 1997).

Ames (1992) claimed that students who possess learning goals are more likely to maintain positive motivation in school. Students who approach achievement situations with learning goals, think about what they need in order to improve their understanding or skills. Low abilities or low performance would not be considered a failure, but would instead provide information to guide learning, such as increased strategy use (Heyman &
Dweck, 1992). In terms of knowledge-seeking, Alexander (1997) states, "when an individual has a well-defined goal to become knowledgeable or more competent in some topic or domain, it is conceivable that the opportunity to read and study informational text would be quite motivating. This is likely true even in instances when the text is challenging or inconsiderate" (p. 87).

**Performance goals.** Unlike mastery orientation, students who manifest performance goals want to outperform others. Students who possess performance goals are concerned with gaining favorable judgments of their competence (Dweck & Leggett, 1988), or to demonstrate superior ability (Butler, 1993; Nichols, 1984). When students focus on outperforming their peers, they are more likely to choose activities they know they can do well. Performance goals involve judging and validating the adequacy of one's ability (Dweck & Leggett, 1988; Heyman & Dweck, 1992). This judgment creates a negative feeling of helplessness when students may perceive themselves as failures or possessing low ability. When students' confidence is low, they tend to create vulnerability to the helpless pattern (Elliott & Dweck, 1988). Students who focus on performance goals may avoid challenges that could reveal inadequacies (Dweck & Leggett, 1988; Heyman & Dweck, 1992). Likewise, students who have performance as a goal tend to be extrinsically motivated (Wigfield, 1997).

In a study by Bandura and Dweck (1985), students' existing goal preferences were measured. The study found that students with performance goals avoided challenge even when their confidence levels were high. In another study, children were taught scientific principles from instructional booklets and then were tested to see if they
could transfer this knowledge other conceptually related principles. The children who had learning goals, in comparison to the children who had performance goals for the unit, were more successful on the transfer test and could generate more and better strategies even when they were not successful (Farrell. 1985).

Now that learning goals have been distinguished from performance goals, what are the best ways to promote learning goals in the classroom? If mastery or learning goals promote learning and success in school and are another kind of intrinsic motivation to learn, an examination of instructional contexts of how to help students develop these goal orientations is warranted. What are the instructional contexts in which learning goals appear?

**Instructional Contexts to Increase Motivation and Interest**

The first instructional context that will be examined is the Concept-Oriented Reading Instruction (CORI) framework. Guthrie and Alao (1997) described this set of eight principles or characteristics of a classroom context that influence motivations for reading. They include: conceptual themes, real-world experience, self-direction, interesting texts, social collaboration, self-expression, cognitive strategies, and coherence. These principles are expected to apply across a wide range of ages, reading levels, settings, and learning goals. CORI integrates reading/language arts and science for elementary age children. This instructional method was first implemented in a large mid-Atlantic state, but is now being implemented in other states on the East coast.

**Description of CORI principles.** The first principle of CORI is **conceptual**
themes. meaning instruction is organized around broad interdisciplinary themes (e.g.,
adaptation, weather), in which content areas such as reading and language arts, science.
and history are taught simultaneously. The second principle of CORI is real-world
experience (e.g., science observation). This principle focuses on the need for students to
interact with concrete objects, events, and settings by using their senses of hearing,
touch, sight, or smell. Students observe and interact with these objects and then record
their experiences through writing, drawing, or photographing.

The third CORI principle is self-direction, in which teachers enable students to
assume responsibility for their own learning. This is accomplished by teachers helping
students choose the topics, texts, tasks, and media for learning about the conceptual
theme. The fourth principle is interesting texts. Interesting texts, defined by Schraw et
al. (1995), are as easy to understand, contain relevant information, and have vivid details.
Teachers provide a variety of informational resources including: expository books,
references, electronic databases, as well as literature such as folk tales, novels, and
poetry, for students to utilize. Texts range across a variety of reading difficulty levels to
meet the diverse needs of the students.

The fifth CORI principle is social collaboration. This principle emphasizes the
importance of students working together in a variety of social structures. These
structures may include individual work, pairs, small teams, and whole-class activities.
Within these different social structures, students learn the content and strategies relevant
to the conceptual theme. The sixth principle is self-expression. In a CORI classroom,
students are supported in expressing their understanding of the conceptual theme in ways
that are personally meaningful and relevant to them and their audiences. Cognitive strategies is the seventh CORI principle. For students to be successful, teachers need to provide a variety of supports for strategy learning. These include modeling, coaching, scaffolding, explaining, peer discussions, guided practice, independent practice, and student reflection. The final principle of CORI is coherence. This principle is important because this classroom instruction integrates the contents, cognitive strategies, and social interactions for learning by connecting the activities, materials, expectations, and expressions of understanding around multi disciplinary (e.g., science, language arts, mathematics), conceptual themes (e.g., adaptation, weather. Guthrie & Alao. 1997).

Research conducted on CORI classrooms showed the effects this instruction had on students' motivation and conceptual knowledge was significant, compared to traditional methods of instruction. Students in ten classrooms in three schools were involved in a three-year study. Half of these classrooms were CORI classrooms. For example, when students were given a task to search for information about ponds and deserts, the correlations for intrinsic motivation and strategy use were .8 for fifth-grade students and .7 for third-grade students, measured via an interview (Guthrie. Van Meter. McCann. Wigfield. et al., 1996).

Students in CORI classrooms were significantly higher on measures of conceptual knowledge, search strategies, and motivation than were students in traditional classrooms in both third- and fifth-grade. This was true after background knowledge on the topic and literacy levels were accounted for at the beginning of the year. The effect sizes were .7 for third grade and 1.2 for fifth grade. A comparison across grades showed
that the third-grade students in the CORI classrooms exceeded the fifth-grade students in the traditional classroom on the indicator of motivated strategy use in reading. This was also true for measures of conceptual knowledge. Third-grade CORI students exceeded fifth-grade traditional students in terms of their conceptual knowledge on the topic of ponds and deserts, as determined by a one-week performance assessment (Guthrie et al., in press).

The second perspective on contextual principles to enhance intrinsic motivations for learning is Ames's (1992) TARGET program which is based on Epstein's (1988, 1989) six dimensions of the classroom learning environment. The acronym TARGET stands for six structures or dimensions in the classroom: task, authority, recognition, grouping, evaluation, and time. These six salient dimensions of the classroom can be structured to emphasize a mastery goal orientation. Task refers to design of learning activities, tasks, and assignment. These tasks need to be interesting, challenging, and provide students with variety. Designing tasks also includes helping students set realistic goals and ways to organize and manage the steps to reaching those goals. The purpose of these tasks is to increase interest in learning as well as the quality of engagement.

Authority refers to fostering students' self-direction, encouraging students to make decisions and choices, and opportunities for students to take leadership roles. Recognition consists of recognizing individual improvement and effort instead of rewarding social comparison. Grouping focuses on students' ability to work effectively with others. This dimension focuses on students' need for belonging and allows
opportunities for cooperative learning within heterogenous groupings.

Evaluation involves the methods of assessment and monitoring of student learning. This dimension emphasizes a variety of methods for evaluating students for individual progress and improvement as well as giving students opportunities to improve. The focus of evaluation is on improvement of skills, rather than norm-referenced standards. Time refers to the pace of instruction, and the time allowed for students to complete their work. This dimension allows for adjustments to be made for students who need more time, as well as allowing students opportunities to progress at an optimal rate.

The TARGET structure for instruction provides a framework that integrates strategies to promote mastery goal orientations in the classroom. The goal orientation is dependent on how students experience these six dimensions in the classroom (Ames, 1992). This classroom-based program contains many important elements of instruction to enhance motivation. However, the components of real-world experience, strategy instruction, and coherence are not accounted for in this model.

The third review of instructional context variables that enhance intrinsic motivations was done by Stipek (1996). In her review, Stipek addressed three main dimensions of classroom practice that are designed to enhance intrinsic motivation and additional classroom practices that foster learning goals. The three classroom practices that enhance intrinsic motivation include: (a) use of rewards, (b) evaluation, and (c) tasks. These three practices lead to student beliefs or feelings, which in turn lead to specific student outcomes.
The first classroom practice for increasing intrinsic motivation in the classroom addresses the use of rewards. Stipek (1996) suggested that rewards should only be used when necessary. Teachers should emphasize the informational rather than the controlling purpose of rewards. Rewards should be made contingent upon mastery or on a level of performance that all students can achieve with effort. Teachers should minimize things that focus students' attention on extrinsic reasons for engaging in tasks such as deadlines, threats of punishment, or competition. The second classroom practice is evaluation. Teachers should not emphasize external evaluation (e.g., grades), especially for challenging tasks. Helpful, informative, feedback that is based on mastery of skills rather than on social norm-based criteria, should be provided by teachers. The third classroom practice involve the tasks students will do. A variety of challenging tasks that are personally meaningful and encourage student choice should be given.

According to Stipek (1996), to foster students' learning goals, teachers should incorporate the following guidelines into their classroom practices, in addition to the ones mentioned above. Provide various opportunities to demonstrate mastery. Adapt instruction to student's knowledge, understanding, and personal experience. Provide opportunities for discovery and experimentation. Success should be defined in terms of improvement. Effort, learning, and working hard should be emphasized rather than getting the right answer or outperforming others. Finally, mistakes should be treated as natural and normal steps in the learning process.

These three classroom practices lead to student beliefs about themselves as learners, which eventually lead to student outcomes. When students believe they are
competent, have control over their outcomes, and believe that poor outcomes are attributable to low effort or ineffective strategies and good outcomes are attributable to effort and ability, then students are likely to be successful in many ways. Stipek (1996) claimed that these classroom practices encourage students to have goals, to master tasks, to understand, to develop skills, and to learn. These goals result in students being intensely involved in tasks and learning. Students will choose challenging tasks, take risks, and persist when things get difficult. Students will also use effective strategies to solve problems and to monitor their progress. Learning will be at a conceptual level and students will feel self respect and satisfaction with their success.

Both Ames's (1992) TARGET and Stipek's (1996) suggestions for classroom practices to enhance learning goals in the classroom addressed the importance of tasks and evaluation. Stipek's suggestions incorporated many good aspects of effective classroom principles that enhance student motivation, but social collaboration and cohesion were not mentioned. Also, Stipek did not define what a challenging task meant.

The principles of instruction in the CORI classroom context are the foundation for this dissertation study. This study provides a way to examine instructional principles of CORI such as real-world experience (e.g., science observation) and interesting texts, and their influences on children's motivations to read. This combination of science observation and interesting texts may in fact create opportunities for students to develop goals for learning. These goals may set the purpose for seeking knowledge by searching for information about live animals. The heart of the study is to examine the relationship
between instructional principles that enhance intrinsic motivations to read, increase searching for knowledge, and deepen conceptual understanding. The first of these two important instructional context factors, science observation, will be discussed next.

Science Observation Enhances Conceptual Learning and Motivation

Defining Science Observation

The construct of "science observation" is defined as touching and manipulating a concrete, tangible object or experiencing an event that could be particular or multiple. Students may or may not have prior knowledge of this concrete object, but a hands-on experience with this object may provide information on which further knowledge can be extended. For example, students in a fifth-grade classroom may have prior knowledge of a cricket. They may have read about a cricket in a story, seen a cricket in a book, or may have seen the movie Pinocchio and have some idea of what a cricket is. To begin a fifth-grade science unit on biomes and habitats, the teacher and the students go outside and gather live crickets from a grassy field in the schoolyard. Once these crickets have been caught, the teacher allows the students to bring them into the classroom where they are placed in clear plastic containers for the students to study (Guthrie & Wigfield, 1997).

"Observation" is defined as watching, examining, and manipulating (e.g., touching) a concrete object (e.g., a cricket). Interaction may include feeding the cricket and recording what happens. Interaction may be drawing a picture of the cricket and labeling its parts, which requires careful observation and attention. Holding the cricket
and listening to it chirp may be another way to observe. When students are allowed to interact directly with the crickets by using multiple senses (e.g., sight, touch, hearing), and observe the crickets' behaviors, their natural wonder and curiosity is piqued. The students are motivated and interested: discovery is beginning, and a connection to the real-world has been made. Other science observations may include laboratory activities, hands-on activities, demonstrations, and use of manipulatives to construct meaning of concepts and ideas. The rationale for experiential learning is to discover, question, and think, which is where conceptual understanding begins (Guthrie, Van Meter, McCann, Wigfield et al., 1996).

Rationale for Science Observation in Reading Instruction

Science observation, which is similar to experiential learning or inquiry learning, is based on the theory of constructivism. Within constructivism, learning is framed as an active, continuous process, whereby the learner uses information from the environment to construct personal interpretations and meanings based on prior knowledge and experience (Driver & Bell, 1986; Roth, 1990). Learners actively construct knowledge by reflecting on their physical and mental actions (Piaget, 1970). Thus, the learner constructs schemata or cognitive structures that represent the learner's understanding of the world (Saunders, 1992). These constructions of knowledge occur within the context of conflict, confusion (Confrey, 1985) and surprise (Lawler, 1981). Constructivism implies that students require opportunities to experience what they are to learn in a direct way and time to think and make sense of what they are learning (Tobin, 1990). The
construction of understanding involves socially negotiating meaning among members of
a community (Cobb. 1990) through social interactions and cultural transactions
(Vygotsky. 1978).

Disciplined inquiry (Dewey. 1925/1891a) manages the tension between the
stable and precarious, the known and the unknown, by anticipating what will be found in
nature while retaining the ability to be puzzled or surprised. In order to process these
experiences, Dewey believed in the language aspect of negotiating meaning. His
emphasis on language was as strong as his emphasis on experience because "it's through
the language provided by social interaction. that things pass from external to internal"
According to Dewey. we "learn by doing" and language is the way we make sense of the
world. First we experience phenomena, then we discuss this experience with others.
through language, until meaning is achieved.

This process of language and experience is what Dewey called systematic inquiry:
"learning in a community (social setting) with objects of physical and social
phenomena--located in the real world--that are transformed through the process of
inquiry or interrogation" (Prawat. 1995. p.18). Language plays a key role in this
process. but so do the objects of knowledge (Dewey. 1825/1981: Prawat. 1995). Dewey
believed that objects of knowledge offer up surprises or inconsistencies that are
integrated into the concept (resulting in greater overall coherence) or the idea is rejected
or reworked (Prawat. 1995).

Curiosity or wonder about the world contributes to the qualitative changes in
process that mark the transition from "ordinary perception" to "scientific thinking"
discourse communities that allow students to work through their ideas and apply them to
real-world phenomena that they can then see in a new way. Teachers need to keep
working with students to create ideas, and keep testing students to describe and explain
important phenomena that is new (Prawat. 1995).

Support for discovery learning in the literature includes a study by Tobin (1984)
in which students (grades 6-8) were examined in regard to task involvement in activity-
oriented science lessons. Investigation planning, data collection, and data processing
were the three student motivation factors in the study. Among these three, overt
engagement was prevalent only when data were collected. Students usually engaged in
data collecting tasks in work groups. Data collection results suggest a strong
relationship between the time allocated to data collection (22% of the time) and the
amount of student data collection that occurred. Manipulated materials were used in
data collection: graph paper, charts, and tables were used when data were processed.
Comprehending tended to occur after data had been collected. A discovery method of
instruction (i.e., activity-oriented method) improved attitudes toward science among
tenth-grade biology students when compared to students exposed to lecture or
expository instruction (Ajewole. 1991). So how do teachers create a context for
discovery learning to occur? How do teachers create a context for discovery learning?
Creating a Classroom Environment for Science Observation

It seems classroom contexts that foster experience and interaction with real-world phenomena and relevant activities might also enhance motivations for wonder and curiosity, questioning, student choice, social interaction, discussion and communication, problem solving strategies, and conceptual understanding. The social milieu can lend this support for experiential learning and may be conducive to increased intrinsic motivation and increased strategy knowledge, which leads to increased conceptual understanding (Guthrie. 1996). Creating a classroom context that supports discovery learning will be discussed, based on the current literature. Important elements of this context enhance intrinsic motivations for learning, include: (a) providing a conceptual framework for learning; (b) connecting science observations to the conceptual framework; (c) managing time for social interaction and discussion, and (d) connecting reading and writing activities. These four elements will be discussed below.

Providing a conceptual framework. The first important component of a conducive learning context with science observation is the conceptual framework. Conceptual frameworks provide a frame of reference for students to attach meaning. This framework is a map, if you will, so students can see where they are going in advance. Learning occurs when a conceptual framework is given to students, enabling them to interpret events, provide a scaffold for understanding, and use language to understand. Concrete interactions set processes of questioning into motion (i.e., reflection, wonder, curiosity), which conflicts with one's prior knowledge and compels one to resolve this conflict.
This process transforms our ideas into understanding. Renner, Abraham, and Birnie (1985) incorporated a learning cycle in science activities. The first phase of the cycle involves exploration. This allows students to simply experience the concept before identifying labels are attached to it. Phase two, conceptional invention: students are led by a teacher usually, to identify a concept and assign language to it. Phase three, conceptual expansion, allows the invented concept to be used in ways such as performing additional experiments and reading about the applicability of a concept.

There is, however, a lack of pedagogy in how to engage students. Student engagement rates were higher in classes when teachers used clear explanations and directions during lessons. Engagement rates tended to be higher in classes where teaching methods were matched to objectives and learners. Also, high rates of engagement were associated with classes where a variety of teaching methods were used (Tobin, 1984). Students need a well-defined conceptual framework provided by the instructor and/or quality practice in which students' time is well spent learning a concept (Kuhn & Angelev, 1976; Seigler, Leibert & Leibert, 1973).

The effects of activity-based elementary science programs (SAPA, SCIS, and ESS) on student outcomes was studied (Bredderman, 1983). The primary goal of the SCIS was the development of scientific literacy, defined as basic knowledge concerning the natural environment, investigating ability and curiosity. The activity-based programs frequently used direct experience, experimentation, and observation as the sole sources of information about the natural world. SCIS also enhanced scientific processes (effect size = .52) including questioning, language, and reflection (Allen, 1973). Social
interaction and discussion through language was not an evident part of these science programs. Trade books, student journals, or other forms of literacy were not used in these programs, along with a lack of discussion and communication about the activities, which resulted in a non-significant effect size for conceptual understanding. Complex activities such as making explanations requires conceptual understanding (Chi et al., 194: Chi, Glaser, & Farr, 1988).

**Connecting science observation to the conceptual framework.** Another aspect of a conducive context for science observation is the actual activity or phenomenon that the students encounter. Exciting, relevant activities can create situational interest that motivates and engages students (Schraw et al., 1995). These activities can contribute to the understanding of the concept within the conceptual framework already established. In the domain of science, meaningful learning of science involves coming to understand scientific ideas as they are used for their intended purposes, including description, prediction, and explanation of phenomena in the natural world. Class activities need to engage students in using scientific conceptual schemes to describe, explain, or make predictions about the world around them (Smith, Blakeslee, & Anderson, 1993; Sneider, Kurlich, Pulos, et al., 1984). An important role of the teacher is to facilitate learning by maintaining an environment in which students can make sense of what they are doing and receive challenges and assistance as required (Gallagher & Tobin, 1987). These meaningful activities can be created in various ways.

Problem-centered learning is one way to create a meaningful activity. In an article on constructivist perspectives on science and math learning, Wheatley (1990)
discusses the concept of problem-centered learning which is learning as the adaptations children make in the functioning schemes to neutralize problems or questions that arise through interactions with the world (Steffe, 1990). In short, this is discovery learning. According to Wheatley, activities that promote this type of learning should be accessible to everyone, invite students to make decisions, encourage questioning, encourage students to use their own methods (strategy knowledge), promote discussion and communication, be replete with patterns, lead somewhere, have an element of surprise, be enjoyable, and be extendable. Kiewa (1994) identified components which create a powerful learning situation in the outdoors which are similar to Wheatley's (1990) list. Kiewa's (1994) components begin with an experiential learning base, a meaningful reality, cooperation, a means of processing the experience, success, and choice. These result in learning, self-control, and adventure.

Demonstrations are another way to create motivation through activity. The impact of a science demonstration on fifth-grade students' understanding of air pressure is discussed by Shepardson, Moje, and Kennard-McClelland (1994). For demonstrations to be effective for all children, the Shepardson et al. study emphasized the following factors: all demonstrations need to revolve around the same concept, demonstrations need to clearly and concretely exhibit the attributes of the concept that promotes construction of specific meaning, demonstrations to be seen by everyone, or to be equally accessible. Student engagement rates were higher in classes where materials and equipment were used to provide students with opportunities to practice and achieve the objectives (Tobin, 1984). The demonstrations should test the children's ideas and
students also need time to ask questions and discuss the demonstration. Scientific demonstrations are useful if they challenge children's existing understandings. are conducted in an atmosphere that encourages children both to test their ideas and to construct meaning through social interactions. This way, scientific demonstrations are more likely to foster conceptual understanding. Previous conceptual change research also supports the importance of strategies for using phenomena in demonstrations, laboratory work, or examples for discussion (Smith et al., 1993).

Teacher behaviors can also influence student motivation rates in middle-school science activities. The data also suggest the importance of formal reasoning ability and locus of control as student attributed affect motivation. Motivation rates were enhanced when teacher questions were relevant, clear, and focused at a variety of cognitive levels (Tobin & Capie, 1982).

Laboratory activities or experiments are a third way to engage students in meaningful activities. Laboratory activities can be effective in promoting intellectual development, inquiry, and problem-solving skills (Hofstein & Lunetta, 1982). Further, Hofstein and Lunetta claimed that laboratory activities could assist in the development of observational and manipulative skills in understanding science concepts. Laboratory activities appeal as a way of allowing students to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science (Tobin, 1990). How students engage in laboratory activities also influences how and what they learn. Unfortunately, most studies of classrooms have shown that students do not have many opportunities for direct interaction with phenomena (Tobin, 1990).
For example, Tobin and Capie (1982) found higher achievement is associated with getting involved in a more overt manner. In some covert treatments, students are given a chance to learn how to design an experiment, but they are not given explicit instruction on how to achieve this. For example, students in one study followed experiments from a book and performed these experiments in small groups; but students were not allowed practice activities to design their own experiment based on the examples. nor was there any discussion or explicit teaching of the concept or its mental processes. Effects were modest (Doty. 1985). Another problem is management. Most teachers seem to be distracted with managing activities (Gallagher & Tobin. 1987). There is a high belief among educators that science observations should be taught in classrooms. However, there is a low actual practice of these kinds of activity-based lessons in classrooms.

Managing time for activities and social interaction. The third component of a learning context that enhances motivation through science observation is being able to manage the activity and have it presented in a way that helps rather than hinders understanding of a concept. Management of time for activities is the key in their success as a teaching tool. In order to influence student achievement, teachers need to maintain a classroom environment that is conducive to learning and ensure that students remain productively engaged in relevant learning tasks (Tobin, 1984). Theoretically, managerial variables are most likely to have a direct effect on student motivation. For example, the amount of time allocated to various tasks will affect the opportunity that students have to engage, to complete assigned tasks, or to become involved in off-task activities.
Similarly, the strategies used to organize activities and interact with students are likely to have a direct effect on student motivation (Kounin & Doyle, 1974). Significant relationships between management and student motivation have been obtained in numerous studies conducted over a wide range of subjects and grade levels (Arlin, 1979; Breuning, 1978; Kounin & Doyle, 1974). Research is needed to provide guidelines for teachers on strategies to use in order to promote productive student involvement in tasks associated with process skill learning (Tobin, 1984).

The social milieu in the classroom also enhances motivation for science observation (Guthrie, 1996). Managing student activities can be facilitated by the social or group structure in the classroom. More important than group size, however, is whether or not the teacher is working with the group and how the work of students is being monitored (Cornbleth & Korth, 1979). It is important, therefore, for teachers to use a structure which maximizes motivation during activities.

The social context compels students to discuss and bring language to their observational experience, which enhances motivation and understanding. This can be whole class, small group, or paired groups that facilitate discussion and motivation in tasks. Working in small groups can increase student motivation to learn. Several researchers (Doty, 1985; Lawson, Blake, & Nordland, 1975; Leising, 1986; Wollman & Chen, 1982) enhanced student motivation by having students work in pairs and small groups. Anderson (1996) and Brophy (1983) noted that in order to enhance student motivation to learn, teachers ought to provide opportunities for students to interact with peers and to have overt motivation in academic tasks.
Instruction should provide students with opportunities to engage in appropriate tasks or activities that enable higher cognitive level objectives to be achieved. In high school science classes, teachers use whole class instruction most of the time (Tobin & Gallagher, 1987). This activity structure limits most students to covert participation which is likely to be effective for short periods of time and for certain purposes, such as introduction of new content. In order to engage students more actively, small groups or individualized activities must be used (Tobin, Capie, & Beltencourt, 1988). Structured activities that engage students in appropriately paced learning activities, provide instructions for the activities, and give feedback to the students enhances achievement (Mackenzie, 1983; Ross, 1988). Content also needs to be presented so as to make abstract content more related to personal experiences, concrete or familiar.

Social collaboration enables understandings to be clarified, elaborated, justified, and evaluated (Tobin, 1990). Wollman and Chen (1982) found that skills related to identifying and controlling variables were improved for fifth-grade students when a social interaction technique was used to solicit a solution to a problem, to seek justification for a solution, and to request alternative possible solution. Cooperative learning experiences tend to promote more learning than do competitive or individualistic learning experiences. Although this finding remained constant over a range of age groups, subject areas, and learning activities, the gap in achievement favoring cooperation widens when the learning tasks are more difficult (i.e., problem solving, divergent thinking, decision making, conceptual learning). The need to talk about information and ideas rather than just think about them is one of the variables contributing to higher
achievement (Deutsch, 1962). The last component of a meaningful context in which science observations are made is one that makes the connection from real-world science activities to literacy activities.

**Combining Science Observation with Interesting Texts for Conceptual Learning**

**Defining Interesting Texts**

For this study, interesting texts refer to trade books that are described as having the following characteristics: structural features of a book (e.g., table of contents, index); content confined to a specific domain; composed by one or two authors; attractively illustrated with explanatory diagrams and vivid photographs; relatively short in length; developmentally appropriate; and perceived as attractive and inviting to read.

For this dissertation, interesting texts will be limited to expository books that provide information about crabs and turtles across a variety of reading levels. The information books contain photographs, diagrams, and vivid details of crabs and turtles, as well as information about how crabs and turtles live, survive, adapt, and grow in their respective environments. The information books are interesting because they each contain different kinds of information about crabs and turtles. The information ranges from general to specific, and students are able to search and read as many books as necessary to answer their questions. In this study, this information is contained in one volume, obtained from multiple sources. We refer to multi-texts as this collection of multi-levels, multiple text sources, and information from many trade books, bound into one volume.

Schraw, Bruning, and Svoboda (1995) found that ease of reading and relevance
predicted the personal interest that readers found in texts. In their study, interesting texts are easy to comprehend, have vivid details, and contain relevant information. This study supported the notion that when information is interesting and relevant to students, they read more, and therefore, understand more about the topic of interest.

In a classroom situation, interesting texts may also include other expository books, references, and electronic databases, as well as literature such as novels, folklore, and poetry. These sources of information are provided across a wide range of reading difficulty to suit various student abilities. The informational resources are also centered around a specific conceptual theme (Guthrie & Alao, 1997). The other informational resources such as reference books, electronic databases, as well as literary resources were not included in this study because the study lasted for only one week. I wanted to provide students with choice, and with a variety of rich informational resources without overwhelming them. In a week-long study such as this dissertation, the other informational resources are unnecessary.

**Effect of Interest on Conceptual Learning**

Many researchers have examined the influence of interest on learning from expository texts (see Hidi. 1990; Hidi & Baird. 1986; Schiefele. 1991b. 1992. 1996; Wade. 1992). Schiefele (1996) distinguishes between individual or topic interest and situational or text-based interest (Krapp. 1992). "Topic interest is conceived of as a relatively stable evaluative orientation toward certain topics, while text-based interest is an emotional state aroused by specific text features" (Schiefele. 1996. p. 4).
Furthermore, Schiefele (1996) describes topic interest as a form of individual interest. Individual interest may also include domains of knowledge as well as activities or material objects.

There have been numerous studies in which individual or personal interest has been found to have a positive relationship with text learning (Alexander, Kulikovich, & Jetton, 1994; Asher, 1980; Baldwin et al., 1985; Entin & Klare, 1985; Renninger, 1988, 1989). These studies found that there was a positive impact on learning from text regardless of the text difficulty, age level, students' reading ability, or the type of learning assessment (e.g., multiple choice or free recall). These studies, however, did not examine whether learning occurred on a deep or a superficial level.

In studies examining the level of processing of information, Schiefele and his colleagues (1991a, 1992; Schiefele & Krapp, 1996) found that the use of open-ended questions and free recall explained different levels of learning. For example, Schiefele (1991a, 1992) found that there were differences between simple versus complex questions and main ideas versus amount of specific sentences or phrases remembered. These results suggest that topic interest is more strongly related to deeper level learning than to superficial learning (Schiefele, 1996).

One theory of text processing was used by van Dijk and Kintsch (1983; Kintsch, 1986, 1988) to measure different levels of learning and the relationship to interest. This theory defines three categories of learning: (a) verbatim, which refers to the texts' superficial structure; (b) propositional or text-base, which refers to the meaning of the text, and (c) situational text representation, which refers to "situation" described in the
text such as people, things, or events. The situational level is considered the deepest level of learning. van Dijk and Kintsch hypothesized that students with the highest amount of interest make propositional and situational text representations more than low interest students. Yet, low interest students make more verbatim representations.

A large number of studies suggest that positive emotions, activation, and concentration have an important role in the learning process (Christianson, 1992; Hidi, 1990; Thayer, 1989). Csikszentmihalyi (1988a) examined the relationship of emotional, motivational, and cognitive aspects of experience to define what a quality experience is. A person has a quality experience when three things happen. One is arousal (e.g., feeling energetic); the second is affect (e.g., feeling happy); and the third is concentration. The hypothesis is that interest is significantly and positively related to affect, arousal, and concentration. These three variables mediate significant parts of the influence of interest on text representation (Schiefele, 1996).

Schiefele (1996) conducted an experimental study in which the three variables of affect, arousal, and concentration were examined in relation to students' interest and comprehension in expository text. The three levels of text representation or processing (e.g., verbatim, propositional, and situational) were examined as well as student interest, prior knowledge, and verbal ability. Also, only interest facilitated positive experience during reading. None of the three dimensions of experience was significantly correlated with any of the components of text representation. The results of the study indicated that highly interested readers develop strong propositional or meaning representations of instructional texts. On the other hand, low interest readers assimilate the text in a
superficial way and develop more verbatim representations of the text. These relationships were true for both high and low interest readers, regardless of their prior knowledge and verbal ability. Also, the subjects in this study were of high school age: a study of this kind has not been conducted on elementary age children.

In another study of college age students, Alexander, Jetton, and Kulikowich (1995) examined the interrelationship of knowledge, interest, and recall. The model of domain learning (MDL) developed by Alexander and her colleagues (1995) sheds light on the process of learning within a specific domain and is described in three stages. This MDL acknowledges the continuous interplay of motivational and cognitive factors. In this model, development in a particular field of study is characterized as a progression from an acclimated or novice stage of learning, to a more competent stage, and potentially, to one of expertise or proficiency.

According to the MDL, the first stage of the model is acclimation. Acclimated or novice learners have very little domain or topic knowledge. These students may have some subject-matter knowledge, but it is fragmented and not cohesive. Learners in this stage direct their cognitive efforts toward building a framework for learning subsequent knowledge. Also in the acclimation stage, deep-seated individual interest in the domain is quite low (Hidi, 1990; Schiefele, 1991a) and more short-lived (Alexander et al., 1995). These students are more interested in getting the task completed and are not so much interested in becoming competent and proficient in the domain (Dweck, 1986; Nicholls, 1984). Hidi (1990) calls this less durable and less substantive kind of interest situational because the interest is highly dependent upon the context or situation. In this stage,
readers are more likely to be interested in texts that are more personally involving, sensational, or explicit than those central to the domain or topic but maybe more abstract (Garner, Alexander, Gillingham, Kulikowich, & Brown, 1991; Sadoski, Goetz, & Fritz, 1993).

The second stage, *competency*, is achieved when students have repeated exposure to a domain over time. At this stage, students are more capable at attending to the relevant and important subject-matter content (Jetton et al., 1992), although students may still continue to be attracted to interesting and personally involving information in the text (Wade, 1992). As students increase their level of competence, so does their personal investment in the domain (Alexander et al., 1995). Students in the competency stage organize their declarative and procedural knowledge around basic principles that define the domain (Gelman & Greveno, 1989). When students gain competence, they comprehend and remember more, their intrinsic motivation to learn may become stronger, and their strategy use becomes more effortful and effective (Alexander & Judy, 1988). Hence, students stay more focused on relevant material, use more strategies, comprehend more, and remember more important and central ideas of the content.

The third stage is *proficiency*, and is the most advanced stage of domain learning. Proficient learners have extensive and highly integrated bodies of knowledge within a domain and are also deeply interested and more involved at this stage. Therefore, relatively few students reach this stage in the model (Alexander et al., 1995). To gain proficiency within a certain domain, students must set goals and pursue them, going beyond what is expected of them in regular academic situations. These learners process
information at a deeper level, comprehend, and integrate information more completely than students at the other two stages. Also, students at this stage can elaborate, remember, and understand more than acclimated or competent learners, even when the text is less interesting or more technical (Alexander et al., 1995). Proficient learners continue to read and learn, even if the text is difficult. Their interest in the subject may increase their effort to understand the difficult content (Dewey, 1913). While less proficient learners may not put forth this effort to learn.

In two studies, Alexander, Jetton, and Kulikowich (1995) created dynamic, individual profiles that depicted interactions between knowledge, interest, and recall. In study one, the subjects were premedical students or graduate students in the field of educational psychology. These students were asked to read two passages from the field of human immunology and two from physics. All passages were lengthy and had been used in prior research. After the students had read all four passages, they rated each passage, as well as each of its paragraphs, for interest. The scale of interest ranged from least interesting (1) to most interesting (10). The results yielded three clusters of student profiles. The results of cluster one indicated that the students with the highest amount of subject-matter knowledge were the most interested in the passages of that domain and scored higher on the measures of free recall. On the other hand, the students in cluster three had the least amount of knowledge, reported lower interest, and did not remember as much information as students in other clusters (Alexander et al., 1995).

Study Two included college students taking an undergraduate course in educational psychology. Students rated their interest in the domains of human
immunology and physics on a 7-point likert scale ranging from low interest (1) to high interest (7). Students were also asked to rate their interest in other domains as well. These students read all four passages, as the students did in Study One. After the students read the passages, they rated them on the 10-point scale as in study one. The results yielded four clusters of student profiles.

Cluster 1 in Study Two was similar to Cluster 1 in Study One. These students were the most knowledgeable about the domain, had the most interest, and could remember more information. Cluster 4, on the other hand, was similar to Cluster 3 in Study One. These students possessed limited knowledge about human immunology, their interest in the domain and its related passages, and recall of information from the passages were also relatively low (Alexander et al., 1995). Again, these studies were conducted on college students, which provides the need for the interrelationship of knowledge, interest, and recall to be examined in elementary age children. Schiefele (1996) made a suggestion that future research should include using samples with varying prior knowledge and intelligence and text materials with different difficulty levels. This dissertation examined elementary-age students with a variety of prior knowledge about crabs and turtles, as well as a variety of reading abilities. The text materials included varying degrees of difficulty.

**Effect of Interest on Time Spent Reading**

In one study involving 44 second- and third-grade students. McLoyd (1979), examined the effects of extrinsic rewards on high and low levels of intrinsic interest in
reading. In regards to the interest aspect of the study, students selected a book to read from a possible six books selected by the school’s reading specialist. Individually, the researcher asked each student which book they would rather read. There was time for the researcher to go through each of the six books so the student could choose the most interesting book to them, based on pictures and features of the book. Then, these children were asked to select an activity to do in a free-choice period of ten minutes. In the experimental room, there were books available as well as games and puzzles. Four measures of intrinsic interest in reading the selected book were obtained. These included: (a) number of seconds of contact with the book during free-reading time. (b) number of words read during the free-choice period. (c) whether the first object that the child contacted during the free-choice period was the book, and (d) whether the child responded that reading the book was the most fun thing to do in the experimental room.

The experiment was well-controlled and showed that students who read books that were interesting to them, read for a longer period of time and read a greater number of words compared to the students who read books that were not interesting to them. The students who read the largest number of words and who spent the most time reading were also the ones who did not receive a reward (McLoyd, 1979). Cognitive competence and reader’s interest in a topic are matched with interesting text (Guthrie & Alao, 1997). Morrow (1992) demonstrated that when students were provided a choice of multiple, interesting books, their time spent reading increased and their attitudes towards reading also improved.
Predicted Interaction between Science Observation and Interesting Texts

To examine the effects of motivation and cognitive factors (e.g., student questions) on the acquisition of conceptual knowledge, the current study consisted of an experiment with four treatment groups. The optimal treatment condition allowed students to do science observation of live animals in addition to reading interesting texts.

To increase intrinsic motivations to read, the variable of Science Observation was examined. Science observation involved the use of multiple senses to interact with a live animal. When students are allowed to touch and watch a live animal such as a cricket or a frog, observing the animal's natural behaviors, their natural wonder and curiosity are piqued. The students are motivated and interested: discovery is beginning, and a connection to their world has been made. In this experimental study, the variable of science observation was manipulated to increase attention, interest, and motivation for half of the students. From four groups of students, two groups were provided with opportunities to observe live animals. The other two groups did not observe. One of the science observation groups also read interesting texts. The second science observation group did not read any text. I was interested in the effect of science observation on conceptual knowledge gains, situational interest, and reading motivations. The investigation explored the differences between groups of students who observed live animals and groups of students who did not observe live animals.

A second aspect of reading engagement is strategy use and the acquisition of knowledge through effective reading strategies. To examine growth of conceptual knowledge, the use of Interesting Texts was a second variable. The use of interesting
texts was manipulated to examine the differences between groups of students' conceptual knowledge gains from text. Again, I was interested in the effect of reading interesting texts on conceptual knowledge gains, situational interest, and reading motivations. Two groups of students read interesting texts. One of these interesting texts groups also did science observation. The other group read interesting texts only. Two groups did not read interesting texts. Out of the two groups that did not read interesting texts, one did not read any text; the other group (control group) read their regular science text, which, for the purpose of the study, was not considered interesting.

I expected the two variables of science observation and interesting texts to interact. I predicted that the combination of science observation and reading interesting texts would yield higher conceptual knowledge gains and higher levels of motivation than the other three treatment conditions. I expected that reading interesting texts would increase conceptual knowledge more for the students who observed than it would for the students who read interesting texts and did not observe.

There are many reasons why this hypothesis was made. First, science observation increases motivation. Interacting with live animals is, in fact, exciting and informative. Through observation, students may learn a few new physical characteristics of these live animals. Second, science observation may lead to self-questioning processes that are the result of direct interaction and contact with live animals. Science observation can spark curiosity in children. Once children observe live animals, they are filled with questions, and they have a reason to read. I believe, however, that this motivation is short-lived without books to find answers to these questions. For
example, children may wonder what kind of turtle they are seeing or where it comes from: but they are not able to satisfy their curiosity. Children can observe what kinds of feet an aquatic turtle has, but they are not able to learn about the other kinds of feet other turtles have (e.g., land turtles) without access to information. Consequently, students are unable to answer their questions and gain explanatory information. Without interesting texts to find answers to these questions, students' conceptual learning is limited. The questions students have from their observation can be answered by reading interesting texts. The observation alone may in fact be motivating, but students will not gain knowledge or become informed without reading interesting texts about the topic.

Moreover, science observation creates different levels of questions. Students who observe live animals are curious about them. This leads to many kinds of questions, which in turn lead to subtopics. For instance, students may wonder how many legs a hermit crab has. Upon further observation, students may wonder why two of the hermit crabs' legs stay inside its shell. Then, upon further observation, students may wonder if hermit crabs come out of their shells, and when. Without observation, the subtopic questions of interest and curiosity are not generated. The observation creates the opportunity for many kinds of questions to be asked. Without reading interesting texts, these questions will not be answered.

Third, conceptual knowledge is being learned from reading. When students observe live animals, their interest is heightened, which leads to extensive reading about these animals. Students' questions can guide their search for knowledge. When students read interesting texts about crabs and turtles, they will also gain knowledge about these
animals. Having access to multiple interesting texts about a topic such as turtles can increase the specific and general information available. The interesting texts contain photographs of many species of turtles. Students with access to the interesting texts can compare the photographs in the texts to the real turtle and know what kind it is. With access to books, students can read about various types of shells, the different kinds of feet, and the various colors and sizes of turtles. The interesting texts also contain information about how turtles live and grow, how they survive, and what they eat. Access to multiple interesting texts about turtles keeps students reading and thinking about their observation on turtles.

Fourth, interesting texts may help students organize and validate the information they gain through observation. Reading interesting texts may help students organize what they want to learn about the animal. For instance, after observing a hermit crab, a student may want to read about the functions of pincers. Then, the student may want to read about predators, which may lead to the habitat of a hermit crab. Reading validates the information gained in the observation.

Fifth, observing live animals creates prior knowledge or builds upon a student's prior knowledge. When prior knowledge about a hermit crab is created for a student who has never seen one, they are able to read interesting texts about hermit crabs and build upon this knowledge. Science observation provides students with information about the features and functions of the animals. Students can count all the legs on a hermit crab, watch a hermit crab retract into its shell when approached, and can observe a hermit crab pinching a piece of apple with its pincer. Reading interesting texts helps
elaborate and deepen knowledge about these features and functions. Observation also provides information about the animals' habitats. Reading about these animals' habitats and life cycles broadens students' conceptual understanding and deepens knowledge of forms and functions to systemic and relationship-oriented concepts and principles. Once this principled knowledge (Alexander, Kulikowich, & Jetton, 1994) has been built, students can explain (Chi et al., 1994) this knowledge in a cohesive manner. Observation facilitates explanations (Chi et al., 1994) because students can remember what they observed and connect this knowledge to information they read.

The advantage of interesting trade books is that they contain a depth of knowledge on any one topic. Multiple, interesting texts provide more information than a regular textbook, which may be one reason they are more interesting. There is more to read about the topic. Textbooks are full of small amounts of information on many topics and subjects. For example, interesting texts (e.g., trade books) contain information ranging from physical features of an animal, to functions, to the habitats and life cycles of that animal. Plus, there are many kinds of trade books with various information about the same topic. Students who have access to multiple, interesting texts can take advantage of the abundant information available. There is depth to trade books that is not possible to contain in a classroom textbook. simply because of the topic breadth represented in the textbook.

Finally, and perhaps most importantly, the reason science observation combined with reading interesting texts is powerful is that science observation and reading interesting texts induces additional observation, which is knowledge generating. The
relationship becomes symbiotic. The cycle of observing, questioning, and reading is reciprocal. Students observe, ask questions, and then read interesting texts to find answers. Reading may invoke more questions, more integration with prior knowledge, which may lead to more observation, which may lead to additional reading. This reciprocity is more than additive: it is exponential. Students in this treatment condition have time to gain a deep level of knowledge (e.g., conceptual) because they have all the necessary resources. The relationship between observing and reading interesting texts creates a circular pattern of growth. When both variables are present, they expand each other through a synergistic relationship. This synergy leads to deep conceptual knowledge gains and long-term motivation to read.

I also expected the conceptual knowledge gain to be similar among the other three treatment conditions. The students in the Observe Only treatment condition may have been motivated, but were uninformed. In this condition, the depth of knowledge these students could acquire was limited without access to information. Similarly, the students in the Interesting Texts Only treatment condition may have been informed, but perhaps not as motivated. This group's conceptual learning was limited because the students may not have been as interested in the topic and may have been less motivated to learn. The Interesting Texts Only treatment limited students' motivations and interest to the texts because the interest was bound by the information contained within the text. The motivation to read was not sustained once the newness and initial excitement of the interesting texts waned. I expected the control group, which only had access to the regular classroom science textbook, to also be low in conceptual knowledge gain. This
treatment condition was designed to be like an ordinary lesson in science. The textbook was familiar and students may or may not have been motivated to learn about crabs and turtles. The use of only one textbook limited these students' abilities to gain the level of conceptual knowledge that multiple sources of information provided.
Research Questions

The following questions guided the study.

1. To what extent do science observation or interesting texts reading separately increase motivations to read, and conceptual learning from text: does the combination of science observation and interesting texts reading create a statistically significant interaction?

2. To what extent do situated intrinsic motivations mediate the effects of science observation and reading interesting texts on conceptual learning from text?

3. To what extent does student questioning mediate the effects science observation and interesting text reading on conceptual learning from text?
CHAPTER III

Methodology

Participants

The study was conducted in a public school district in a mid-Atlantic metropolitan area in the United States. There were two schools involved in the study, both of which were located in the same county. The schools were selected based on the principals' and teachers' willingness and interest to participate in the study.

Each school had a multicultural population consisting of approximately 55% African American, 22% Caucasian, 15% Hispanic, and 7% Asian or other. Approximately 40% of the students qualified for subsidized lunch. The reading levels of these students ranged from the 5th to the 80th percentile, based on the Metropolitan Achievement Test (MAT). The grade level was fifth grade. A total of six self-contained classrooms with approximately 28 students in each, from three fifth-grade classrooms per school, participated. A total of 93 students participated in the study from School 1 and 76 students participated in the study from School 2, for a total of 169 subjects. There were 84 boys and 85 girls in the study. Permission to participate in the study was obtained from the participants themselves and from their parents (see Appendix A).

Design

The design of the study was a 2 X 2 Factorial. Experimental Design, shown in Table 1. The factors were: (A) Interesting Texts, and (B) Science Observation.
Table 1

2 x 2 Factorial Design

<table>
<thead>
<tr>
<th>Factor B</th>
<th>Factor A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe</td>
<td>Group 1</td>
</tr>
<tr>
<td></td>
<td>Observe + Texts</td>
</tr>
<tr>
<td>No Observe</td>
<td>Group 3</td>
</tr>
<tr>
<td></td>
<td>Texts Only</td>
</tr>
<tr>
<td></td>
<td>Group 4</td>
</tr>
<tr>
<td></td>
<td>Control Group</td>
</tr>
</tbody>
</table>

Treatment Groups

There were three treatment groups and one control group in the study. All subjects were randomly assigned to one of four groups. Random assignment occurred before the pretest measures were administered. Each group will be described next, along with the activities involved during the one-week intervention. All sessions lasted 40 minutes and were videotaped. All four groups had daily teacher questions (see Appendix B) as part of their activity schedule. A summary of the four different instructional conditions and their daily activity schedule is presented in Table 2. See Appendix C for a detailed, daily chronicle of these activities for each group.
Table 2

Activity Schedule for the Three Treatment Groups and Control Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe + Texts</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
</tr>
<tr>
<td></td>
<td>Preview booklet Read</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td>Observe Only</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
<td>Observe &amp; draw Teacher questions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Write story</td>
<td></td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Share with buddy</td>
<td></td>
<td>Share with buddy</td>
</tr>
<tr>
<td>Texts Only</td>
<td>Preview booklet Teacher questions Read</td>
<td>Teacher questions Read &amp; write</td>
<td>Teacher questions Read &amp; write</td>
<td>Teacher questions Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td></td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Share with buddy</td>
<td></td>
<td>Share with buddy</td>
</tr>
<tr>
<td>Control Group</td>
<td>Preview textbook Teacher questions Read</td>
<td>Teacher questions Read &amp; write</td>
<td>Teacher questions Read &amp; write</td>
<td>Teacher questions Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td></td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Share with buddy</td>
<td></td>
<td>Share with buddy</td>
</tr>
</tbody>
</table>

Note: Students in the Observe + Texts, Texts Only, and the Control groups were given a Writing Log for each day of the treatment. Students in the Observe Only treatment were given an Observation Log instead of a Writing Log daily.

Group 1: Science observation + interesting texts group. The first treatment condition was the Observe + Texts treatment group. There were 23 students in the observe + texts group at School 1 and 19 students in the observe + texts group at School 2. Students in this treatment condition were given a 74-page booklet of interesting texts as their resource for the week. The interesting texts booklet was made from 14 different, expository, trade books and contained information about crabs and turtles, as well as other animals. The book contained different sections of information with a multi-level of text difficulty to accommodate the wide range of reading ability. This booklet is described in more detail in the Materials section. Students in this group also had access to live turtles and live hermit crabs. Students gained their knowledge from direct, hands-
on. observation and interaction with these animals as well as from the interesting texts.
Students in the observe + texts treatment observed the animals daily. They observed for
a total of 40 minutes for the week, an average of 10 minutes per day. Students read
interesting texts for a total of 80 minutes, an average of 20 minutes per day. While
reading, students were encouraged to write as much as possible about the knowledge
they gained. Students in this group also spent time sharing their knowledge with a buddy
for a total of 10 minutes. A total of 30 minutes was spent on measures for the week.

Group 2: Science observation only. The second treatment condition was the
Observe Only treatment group. There were 23 students in the observe only group at
School 1 and 19 students in the observe only group at School 2. Students in this
treatment condition were not given any text. Students in this group had access to the
live turtles and live hermit crabs. Students gained their knowledge through direct,
hands-on, observation and interaction with these animals. Students in the observe only
treatment observed the animals daily. They observed for a total of 80 minutes for the
week, an average of 20 minutes per day. While observing, students were encouraged to
draw and label what they saw. Students in this group also spent time sharing their
knowledge with a buddy for a total of 10 minutes. A total of 30 minutes was spent on
measures for the week.

Group 3: Interesting texts only. The third treatment condition was the Text Only
treatment condition. There were 23 students in the texts only group at School 1 and 18
students in the texts only group at School 2. Students in this treatment condition were
given the same 74-page interesting texts booklet as the students in Group 1. Students in
the text only treatment read for a total of 120 minutes for the week, an average of 25 minutes per day, which included time previewing the interesting texts booklet. While reading, students were encouraged to write as much as possible about the knowledge they gained. Students in this group also spent time sharing their knowledge with a buddy for a total of 10 minutes. A total of 30 minutes was spent on measures for the week.

**Group 4: Control group.** The control group was used as a basis for comparison of traditional or regular classroom instruction to the three treatment conditions. There were 24 students in the control group at School 1 and 20 students in the control group at School 2. Each session lasted for 40 minutes and was videotaped. Students in the control group had an identical activity schedule to the texts only treatment, except for text used. Students in the control group used their regular classroom science textbook as a resource during the week. This textbook was the only reading material the students used. Students in the control group read for a total of 120 minutes for the week, an average of 25 minutes per day, which included time previewing their textbook. While reading, students were encouraged to write as much as possible about the knowledge they gained. Students in this group also spent time sharing their knowledge with a buddy for a total of 10 minutes. A total of 30 minutes was spent on measures for the week.

**Materials**

**Interesting texts.** A 74-page interesting texts booklet was provided for every student in the texts only treatment and the observe + texts treatment. A study conducted by Schraw, Bruning, and Svoboda (1995), showed that relevance and ease of reading
predicted personal interest that readers found in text. In their study, interesting texts had vivid details, contained relevant information, and were easy to comprehend. All students needed to have the same information, so an interesting texts booklet was made from informational trade books. The 74-page interesting texts booklet was made from 14 different trade books with information about crabs, turtles, and other animals. The original trade books were not provided to guarantee that all students had access to the same information.

The text and illustrations for the interesting texts booklet were photocopied from the original trade books. There were a total of 20 color-copied pages in the interesting texts booklet. Random pages from the trade books with pictures of crabs and turtles were color-copied to add interest to the black and white pages. The color copies created a level of authenticity to real trade books that enhanced the black and white photocopied pages. The entire booklet could not be color-copied because of the copyright laws and cost involved. The 74-page interesting texts booklet contained the following sections: a Table of Contents, five sections with information about crabs, five sections with information about turtles, one section with information about both crabs and turtles, one section with information about bats, one section with information about camels, a Glossary, and an Index. The sections about bats and camels were distractors.

Complex search tasks are defined as having the following four characteristics: (1) the question makes a comparison (e.g., crabs vs. turtles). (2) the task includes multiple texts; (3) there are multiple categories within the multiple texts. and (4) there are distractions in the possible text selections (Mosenthal, 1985).
The interesting texts booklet contained varying degrees of text difficulty and page length to accommodate the different reading levels of the students. Text difficulty ranged from second to sixth grade levels, based on Reading Recovery's book leveling (Clay, 1991). Page length of sections ranged from 2-14 but the longer sections had more illustrations and less text. All of the sections had multiple illustrations, with the exception of one, which did not have any illustrations. The Glossary contained 45 important and perhaps unfamiliar words that were defined in simple terms (e.g., antennae, cold-blooded, environment, invertebrate, scavenger), and arranged alphabetically. The Index contained 39 alphabetized words or concepts that were mentioned repeatedly throughout the booklet (e.g., crustaceans, environment, reptiles, shell, tide).

Science textbook. The control group used their regular fifth-grade classroom science textbook, published by Addison-Wesley. The students had access to all chapters in the book. There was limited information in this textbook about turtles and reptiles, and less information about crustaceans. There was a small amount of information about lobsters, but no information about crabs. There were colored illustrations and photographs of turtles and lobsters in the textbook.

Objects for science observation. Students in the observe only treatment and the observe + texts treatment had access to live animals. There were two red-eared slider turtles and nine hermit crabs for observation. Each turtle was contained in a separate 10-gallon aquarium tank with water, rocks, and pebbles. There were three small containers for hermit crabs. three hermit crabs in each. There was also food, an empty shell.
pebbles, and logs for the hermit crabs in their containers. The animals were concealed in
a corner of the room at each school, so students in the control group and the texts only
treatment did not see them. Latex gloves were provided daily for each student as a
safety measure against possible germs from the turtles.

Writing logs. Students in the control group, texts only, and the observe + texts
conditions had a writing log for each day of the treatment. The writing logs were used
to take notes and to write down questions and answers. I encouraged all students to
write as much as possible in their logs every day. A blank page was added to the writing
logs for the students in the observe + texts treatment group. They needed this page for
drawing. The other two groups did not have a drawing page (see Appendix D).

Observation logs. Students in the observe only group had an Observation Log
for each day of the treatment. This log contained a blank page for drawing, and pages
for the students to write their story on Wednesday. This treatment condition did not
have any text, so the wording in the observation log differed from the wording in the
writing log to reflect the emphasis on science observation and drawing (see Appendix E).

Visual aids. There were two posters on the blackboard every day. One poster
had the day’s questions. These questions remained the same for all four groups. The
second poster listed the activities for the group. Each group had a separate poster for
each day; these posters were displayed prior to the students entering the room (see
Appendix B).
Measures

Measures included the following, in order of administration: (a) reading comprehension ability, (b) prior knowledge, (c) situational interest, (d) student questioning, (e) conceptual knowledge, and (f) reading motivation. Table 3 shows the activities for the week. The measures are in **bold** type.

Table 3

Administration of Measures Schedule

<table>
<thead>
<tr>
<th>Group</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observe + Texts</strong></td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
</tr>
<tr>
<td></td>
<td>Preview booklet</td>
<td>Student questions</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td>Read &amp; write</td>
<td>Situation Interest</td>
<td>Share with buddy</td>
</tr>
<tr>
<td></td>
<td>Situation Interest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Observe Only</strong></td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
</tr>
<tr>
<td></td>
<td>Teacher questions</td>
<td>Student questions</td>
<td>Teacher questions</td>
<td>Teacher questions</td>
</tr>
<tr>
<td></td>
<td>Situation Interest</td>
<td>Teacher questions</td>
<td>Write story</td>
<td>Teacher questions</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Situation Interest</td>
<td>Write story</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Share with buddy</td>
</tr>
<tr>
<td><strong>Texts Only</strong></td>
<td>Preview booklet</td>
<td>Student questions</td>
<td>Teacher questions</td>
<td>Teacher questions</td>
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<tr>
<td></td>
<td>Teacher questions</td>
<td>Teacher questions</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td>Read &amp; write</td>
<td>Situation Interest</td>
<td>Share with buddy</td>
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<td>Situation Interest</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Control Group</strong></td>
<td>Preview textbook</td>
<td>Student questions</td>
<td>Teacher questions</td>
<td>Teacher questions</td>
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<td></td>
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<td>Teacher questions</td>
<td>Read &amp; write</td>
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<tr>
<td></td>
<td>Read</td>
<td>Read &amp; write</td>
<td>Situation Interest</td>
<td>Share with buddy</td>
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<tr>
<td></td>
<td>Situation Interest</td>
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**1st Friday:** Administration of the Metropolitan Achievement Test (MAT) and Prior Knowledge Assessment in students' homeroom classrooms.

**2nd Friday:** Administration of the Conceptual Knowledge Assessment and the Reading Motivation Questionnaire in students' homeroom classrooms.

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Reading comprehension. Students' reading comprehension was measured on the basis of the Metropolitan Achievement Test (MAT). The total number of correct responses was entered as a raw score; no conversions were made. This score was used
as a covariate in the data analyses to control for reading ability. The MAT was administered on the first Friday of the study in each school, prior to the treatment conditions. Students were assessed in their own homeroom class and were given 40 minutes to complete the assessment.

**Prior knowledge.** The students' prior knowledge was measured with a knowledge question about crabs and turtles. This question was derived from the conceptual knowledge question and was given to assess students' prior knowledge about crabs and turtles. This assessment was given directly following the MAT on the first Friday of the study (see Appendix F). Students had as much time as they needed. Most students wrote for 10-20 minutes.

**Situational interest.** Students' situational interest was measured on Monday and on Wednesday. Monday's measure was titled Situational Interest1 and Wednesday's measure was titled Situational Interest2. A page was added to the writing log and observation log that asked students to circle their rating of how much they enjoyed the activities for the day. Students were asked to support these ratings with as many reasons as possible (see Appendix G).

**Student questioning.** Student self-generated questions were measured on Tuesday for all groups. In the writing and observation logs, there was a page for student questions. At the beginning of each session on Tuesday, students were asked to write down as many questions as possible from their curiosity or science observations. Student questions were analyzed in two ways. Question1 is the average score for the quality of questions asked. Question2 is the total number of questions asked. These
measures are discussed in further detail in the Coding of Measures section.

**Conceptual knowledge.** The students' conceptual knowledge was measured on Friday, as a posttest measure. Conceptual knowledge was measured in two ways: drawing and writing (see Appendix H). Students were given as much time as necessary, using approximately 10 minutes to draw and 40 minutes to write. These conceptual knowledge measures are titled Draw and Write.

**Reading motivation.** The students were given a reading motivation questionnaire to measure reading motivation. The questionnaire contained 30 items and students answered each item on a 1 to 4 scale. The questionnaire items included one intrinsic motivation composite, which included four sub-scales: (a) efficacy, (b) curiosity, (c) involvement, and (d) challenge. To control for response bias, one extrinsic sub-scale of work avoidance questions was included. The construct of work avoidance correlates significantly negatively with the intrinsic component sub-scales (Wigfield & Guthrie, 1997). Half of the questions focused on general reading motivation questions, while the other half were task specific to the crab and turtle learning (see Appendix I).

**Coding of Measures**

**Prior knowledge.** A coding rubric for scoring the prior knowledge was based on the existing Concept-Oriented Reading Instruction (CORI) rubric (see Appendix J). This rubric was developed and modified to include the conceptual scope of the crab and turtle learning task. The rubric has six levels representing varying degrees of conceptual knowledge. A graduate student was hired as an independent coder. I trained her on the
rubric with a random selection of 16 student responses, four from each treatment group. Once she understood the rubric and felt comfortable using it, together, she and I proceeded to establish interrater agreement. I selected a second random sample of 20 student responses, 5 from each group. I photocopied these responses and gave the independent coder a copy of them to code. I coded the same sample of 20 responses. A week later, we met to discuss the scoring of the sample. We had 70% (14 out of 20) actual agreement, and 100% adjacent agreement.

Situational interest. A new rubric was developed to score these responses (see Appendix K). The same rubric applied to both days. A second graduate student was hired as an independent coder to help develop this rubric and to code the data. The rubric for situational interest also contained six levels, based on conceptual knowledge. The levels varied depending on interest level, quality, and nature of supporting reasons only. The actual rating was not taken into consideration. The reasons supported interest in the topic, the task, both the topic and the task, neither the topic nor the task, and interest in learning as a goal. The second independent coder and I developed this rubric from a random sample of 16 student responses from Monday. These were the same 16 students that were used in the prior knowledge sample.

Once the rubric was formulated, we tested the rubric on these same 16 student responses from Wednesday. To establish interrater reliability with this rubric, I selected a second sample of 20 students, 5 from each group. These were the same 20 used in the prior knowledge scoring. I photocopied the 20 student responses for Monday and Wednesday and gave a copy to the independent coder to score. I scored the same 20
responses for Monday and Wednesday. A week later, we met to discuss the results. We had 70% (14 out of 20) actual agreement and 100% adjacent agreement on Monday's response. We made one change to the rubric and added the students' rating of the activity into the definition at each level. This addition defined the rubric better and made it more objective. When we each adjusted our scores to reflect this change, we had 95% (19 out of 20) actual agreement and 100% adjacent on Wednesday's response. Each student had one score for each day. Monday's responses were titled Situational Interest1 and Wednesday's responses were titled Situational Interest2.

Student questioning. A new rubric was developed to code students' questions. The same graduate student who helped me develop the situational interest rubric also helped me develop this rubric. The same beginning sample of 16 students used for prior knowledge and situational interest were used for development of the questioning rubric. As we both thought of ways to score the questions, we noticed that the responses fit the same pattern as the levels on the conceptual knowledge rubric (see Appendix J). We found the conceptual knowledge rubric worked well with these responses because the questions were based on conceptual ideas.

To establish interrater reliability, I selected student responses from the same 20 students used in the prior knowledge and situational interest rubrics. I photocopied these responses and gave them to the independent coder to score. I scored the same 20 responses. A week later, we met to discuss the results. We agreed that we had a difficult time scoring the responses and needed a more objective method, so we put the second sample of 20 aside and used the first sample of 16 to make changes. We started
over with the first group of 16 and scored each question separately. Once we had a score for each question, based on the conceptual knowledge rubric, we added these scores and divided by the total number of questions. This gave us an average score for the quality of the question. We then decided to have a second score, which reflected the total number of questions the student generated. This score was simply the total number of questions asked. This method for scoring was more objective. We agreed to re-code the second sample of 20 responses. A week later we met to discuss the results. We had 90% (18 out of 20) exact agreement and 100% adjacent agreement. The discrepancies were important distinctions between structures and functions. We resolved these problems and the independent coder felt comfortable about proceeding to code the remaining student responses.

**Conceptual knowledge.** The same rubric that was used to measure prior knowledge was used to measure both the drawing and the writing portion of this assessment. The same independent coder who scored the prior knowledge responses also scored these responses. The first sample responses on draw and write portions from the same 16 students were used for consistency and to train the independent coder on the drawing portion of the assessment. After scoring these 16 responses, we needed to extend the present rubric for the writing portion of the assessment to account for the knowledge growth of a few students. There were two students who scored a level 6 on the prior knowledge assessment, meaning these students began with a deep conceptual knowledge of crabs and turtles. When we scored the writing portion of the conceptual knowledge assessment, they had knowledge growth for which we needed to account.
The independent coder and I extended the present rubric to a level 9. Level 7 included a level 6 response with elaborated features on both crabs and turtles. To receive a Level 8 score, a student had to provide a level 7 response with elaborated functions for both crabs and turtles. To reach a Level 9, a student had to provide a level 8 response with elaborated systemic relationships for both crabs and turtles.

To establish interrater reliability, I photocopied a second sample of 20 responses for draw and write (the same 20 students), and gave a copy of the responses to the independent coder to score. I scored the same 20 responses. A week later, we met to discuss the results. We had 85% (17 out of 20) actual agreement and 100% adjacent agreement for Draw. We had 90% (18 out of 20) actual agreement and 100% adjacent agreement for Write, using the extended rubric. Each student had one score for draw (possible scores ranged from 1 to 6) and one score for write (possible scores ranged from 1 to 9).

**Reading motivation.** Each of the 30 items on the reading motivation questionnaire was entered for each student. To analyze these items, two factor analyses were conducted. The first exploratory factor analysis yielded nine factors and accounted for 63% of the variance. The first factor having an eigenvalue of 6.48 accounting for 22% of the variance. However, these factors did not represent theoretically cogent constructs. Therefore, a second factor analysis was conducted with a varimax rotation that extracted a 3-factor solution. The factor loading of items on the reading motivation questionnaire are presented in Table 4. The three factors combined, accounted for 36% of the variance.
Table 4

Factor Loadings of Items on the Reading Motivation Questionnaire

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Intrinsic Motivation</th>
<th>Topic Interest</th>
<th>Reading Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 26</td>
<td>.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 22</td>
<td>.61</td>
<td></td>
<td></td>
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<tr>
<td>Item 4</td>
<td>.57</td>
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<tr>
<td>Item 18</td>
<td>.56</td>
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<td>Item 19</td>
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<td>Item 21</td>
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<tr>
<td>Item 20</td>
<td>.49</td>
<td></td>
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<tr>
<td>Item 27</td>
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<td>Item 28</td>
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<td>Item 30</td>
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<td>Item 23</td>
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<td>Item 14</td>
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<td>Item 29</td>
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<td>.69</td>
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<tr>
<td>Item 17</td>
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<tr>
<td>Item 12</td>
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<td>Item 10</td>
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<tr>
<td>Item 25</td>
<td></td>
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<td>.48</td>
</tr>
<tr>
<td>Item 5</td>
<td></td>
<td></td>
<td>.48</td>
</tr>
</tbody>
</table>

Note: Factor loadings less than .40 are not presented.

The first factor of motivation, Intrinsic Motivation, was characterized by items about curiosity, involvement, and challenge. This factor had an eigenvalue of 6.48 and accounted for 22% of the variance. Items on the questionnaire about Intrinsic Motivation included the following: (a) Item 26: I can find information about living animals by reading; (b) Item 18: I learn more from reading about living things than most
students in the class: and (c) Item 20: I read about my hobbies to learn more about them.

The second factor of motivation, Topic Interest, was characterized by items that were about the topic of crabs and turtles. These items were specific to the topic and task from the intervention. This factor had an eigenvalue of 2.35 and accounted for 8% of the variance. Items on the questionnaire about Topic Interest included the following: (a) Item 30: I enjoyed finding lots of information about crabs and turtles; (b) Item 23: I thought it was interesting to study crabs and turtles; and (c) Item 17: I like to learn about crabs and turtles and find out new facts.

The third factor of motivation, Reading Efficacy, was characterized by items that reflected students’ beliefs about their own ability to read. This factor had an eigenvalue of 2.04 and accounted for 7% of the variance. Items on the questionnaire about Reading Efficacy included the following: (a) Item 2: I like hard, challenging books; (b) Item 9: I am a good reader; and (c) Item 10: Sometimes I don’t feel as smart as others in reading.

Procedures

Administration of measures. Tables 5 and 6 shows the schedule for administration of measures for school 1 and school 2, respectively. The Metropolitan Achievement Test (MAT) and prior knowledge assessment were given on the first Friday in students’ homeroom classrooms. The intervention of treatment conditions began the following Monday and continued through Thursday. The first situational interest question was given on Monday. The student questioning occurred on Tuesday. The second situational interest question was given on Wednesday. The conceptual
knowledge assessment and reading motivation questionnaire were given on the Friday after the intervention ended.

Table 5  
**School 1**: Administrative Schedule for Treatment Group Rotation and Measures for Each Day

<table>
<thead>
<tr>
<th>Time:</th>
<th>Monday:</th>
<th>Tuesday:</th>
<th>Wednesday:</th>
<th>Thursday:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:15-8:55</td>
<td>Group 4</td>
<td>Group 3</td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>Measures:</td>
<td>Situation Interest</td>
<td>Questioning</td>
<td>Situation Interest</td>
<td></td>
</tr>
<tr>
<td>10:20-11:00</td>
<td>Group 3</td>
<td>Group 1</td>
<td>Group 2</td>
<td>Group 4</td>
</tr>
<tr>
<td>Measures:</td>
<td>Situation Interest</td>
<td>Questioning</td>
<td>Situation Interest</td>
<td></td>
</tr>
<tr>
<td>11:10-11:50</td>
<td>Group 2</td>
<td>Group 2</td>
<td>Group 4</td>
<td>Group 3</td>
</tr>
<tr>
<td>Measures:</td>
<td>Situation Interest</td>
<td>Questioning</td>
<td>Situation Interest</td>
<td></td>
</tr>
<tr>
<td><strong>Lunch break</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:05-1:45</td>
<td>Group 1</td>
<td>Group 4</td>
<td>Group 3</td>
<td>Group 1</td>
</tr>
<tr>
<td>Measures:</td>
<td>Situation Interest</td>
<td>Questioning</td>
<td>Situation Interest</td>
<td></td>
</tr>
<tr>
<td><strong>2nd Friday</strong>: Administration of Conceptual Knowledge Assessment and Reading Motivation Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**: Group 1=Observe – Texts; Group 2=Observe Only; Group 3=Texts Only; Group 4=Control Group.
Table 6

School 2: Administrative Schedule for Treatment Group Rotation and Measures for Each Day

<table>
<thead>
<tr>
<th>Time:</th>
<th>Monday:</th>
<th>Tuesday:</th>
<th>Wednesday:</th>
<th>Thursday:</th>
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<tbody>
<tr>
<td></td>
<td>Group 4</td>
<td>Group 1</td>
<td>Group 4</td>
<td>Group 4</td>
</tr>
<tr>
<td></td>
<td>Situation Interest1</td>
<td>Questioning</td>
<td>Situation Interest1</td>
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<tr>
<td>10:30-11:10</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Measures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:15-11:55</td>
<td>Group 3</td>
<td>Group 3</td>
<td>Group 3</td>
<td>Group 3</td>
</tr>
<tr>
<td></td>
<td>Situation Interest1</td>
<td>Questioning</td>
<td>Situation Interest1</td>
<td></td>
</tr>
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<td></td>
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<td>12:00-12:40</td>
<td>Group 1</td>
<td>Group 4</td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td></td>
<td>Situation Interest1</td>
<td>Questioning</td>
<td>Situation Interest2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1:50-2:30</td>
<td>Group 2</td>
<td>Group 2</td>
<td>Group 2</td>
<td>Group 1</td>
</tr>
<tr>
<td></td>
<td>Situation Interest1</td>
<td>Questioning</td>
<td>Situation Interest2</td>
<td></td>
</tr>
</tbody>
</table>

2nd Friday: Administration of Conceptual Knowledge Assessment and Reading Motivation Questionnaire

Note: Group 1 = Observe - Texts; Group 2 = Observe Only; Group 3 = Texts Only; Group 4 = Control Group.

Administrative procedures for the treatment groups. The instruction for the study was held in a separate, private classroom, with the exception of the first day of treatment at School 1. The first day of instruction at School 1 was held in a homeroom classroom for all four groups, because the private classroom was unavailable. The following days of the intervention were held in the private classroom for all groups. I was the instructor for all four groups for the one-week study. Each session lasted for 40 minutes and was videotaped. See Appendix B for a detailed, daily chronicle of the procedures.
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followed the same format, procedures, and time constraints. She verified that the four groups were implemented as planned.

Pilot Study

Participants

The pilot study was conducted in a public school district in a large mid-Atlantic metropolitan area in the United States. Only one school participated in the pilot study. The school was selected based on the principal's and a teacher's willingness to participate. The population of the students was multi-cultural with approximately 40% of the students qualifying for subsidized lunch. The reading levels of these students ranged from 5 to 80 percentiles. based on the California Test of Basic Skills. The grade level was fifth grade. There were 20 students from 1 classroom who participated in the study. Permission to participate in the study was obtained from the participants themselves and from their parents.

Design

The design of the study was a 2 X 2 Factorial Experimental Design and shown in Table 1 on page 90. The factors were: (A) Interesting Texts. and (B) Science Observation.

Treatment Groups

There were three treatment groups and one control group in the pilot study. Subjects were randomly assigned to all four groups. The control group and the three treatment groups were the same as described in the dissertation study. A summary of the
four instructional conditions and their daily activity schedule is presented in Table 7.

Table 7

**Pilot Study:** Activity Schedule for the Three Treatment Groups and Control Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe + Texts</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
</tr>
<tr>
<td></td>
<td>Preview booklet</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
</tr>
<tr>
<td>Observe Only</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
<td>Observe &amp; draw</td>
</tr>
<tr>
<td></td>
<td>Share picture</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
</tr>
<tr>
<td>Texts Only</td>
<td>Preview booklet</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
</tr>
<tr>
<td>Control Group</td>
<td>Preview textbook</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
<td>Read &amp; write</td>
</tr>
<tr>
<td></td>
<td>Read</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
<td>Share knowledge</td>
</tr>
</tbody>
</table>

**Materials**

The materials for the pilot study were the same as the materials for the dissertation study. For the pilot study both turtles were kept in one 10-gallon aquarium on a table and there were only six hermit crabs kept in a 10-gallon tank with pebbles, logs to walk on, water, and an empty shell. Science observation was simplified because the groups were so small: everyone had ample access to the animals.

**Measures**

Measures for the pilot study included the following: (a) prior knowledge, (b) student questioning, (c) situation interest, (e) conceptual knowledge, and (f) reading motivation.
Procedures

Weekly activity schedule for the treatment groups. Table 8 shows the weekly schedule for the groups and their rotation. The measures for each day are included.

Administrative procedures for the treatment groups. The instruction for the study was held in the back of a third-grade classroom, which was sectioned off from the rest of the class. I was the instructor for all four groups for the one-week study. There were 4-5 students in each group; they all sat at one table. Each session lasted for 40 minutes and was videotaped.

Table 8

Pilot: Administrative Schedule for Treatment Group Rotation and Measures for Each Day

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:45-10:30</td>
<td>Group 4 Questioning Situation Interest</td>
<td>Group 1 Questioning Situation Interest</td>
<td>Group 2 Questioning Situation Interest</td>
<td>Group 3 Situation Interest</td>
</tr>
<tr>
<td>Measures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00-11:40</td>
<td>Group 3 Questioning Situation Interest</td>
<td>Group 4 Questioning Situation Interest</td>
<td>Group 1 Questioning Situation Interest</td>
<td>Group 2 Situation Interest</td>
</tr>
<tr>
<td>Measures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:15-1:00</td>
<td>Group 2 Questioning Situation Interest</td>
<td>Group 3 Questioning Situation Interest</td>
<td>Group 4 Questioning Situation Interest</td>
<td>Group 1 Situation Interest</td>
</tr>
<tr>
<td>Measures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch break</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2:00-2:40</td>
<td>Group 1 Questioning Situation Interest</td>
<td>Group 2 Questioning Situation Interest</td>
<td>Group 3 Questioning Situation Interest</td>
<td>Group 4 Situation Interest</td>
</tr>
<tr>
<td>Measures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2nd Friday: Administration of Conceptual Knowledge Assessment and Reading Motivation Questionnaire

Note: Group 1=Observe + Texts; Group 2=Observe Only; Group 3=Texts Only; Group 4=Control Group
Instructional treatment check. Students were videotaped each session. each day.

Videotaping served as an implementation check for observation of the treatment
conditions. making certain they were carried out as planned.

Changes in experiment based on the pilot study. The pilot study was informative
in two ways. The pilot informed the treatment conditions. The observe only group did
not have any text. so by Wednesday. the students in this group became a behavior
problem. Since the other treatment groups were reading and writing. a decision was
made to have the observe only students write a story using their knowledge about crabs
and turtles. In the dissertation. the story writing helped keep the students in the observe
only treatment focused.

Second. the pilot study informed the measures. In the pilot study. there was no
baseline measure for reading comprehensive ability. so a decision was made to include
administration of the Metropolitan Assessment Test (MAT) for the dissertation study to
establish this baseline. In the pilot study. the activities included students generating their
own questions each day and sharing their knowledge with their friends each day. Since
student generated questioning does not regularly occur in a traditional classroom. in the
dissertation study we added teacher generated questions to be more like traditional
instruction and allowed student generated questions to occur one day during the week.
Social Interaction was not a measured variable in the study. so we decided to eliminate
this element in the dissertation study until the end of the week. In the pilot study.
situation interest was gathered every day. Students were asked to rate their enjoyment
of the day's activities on a scale from 1 to 10. which was not well defined at each point.
They were asked to provide reasons why they did or did not enjoy the activity. Upon analysis of the data, we decided that assessing situational interest on a daily basis was producing socially desirable answers because 95% of the responses were 10. In the dissertation study, the situation interest measure was changed to include a rating scale with only three items. Students were also asked to support their ratings with specific reasons. In the dissertation study, situation interest was only measured on Monday and Wednesday, allowing students more time to think and answer this question.
CHAPTER IV

Results

The descriptive statistics on all the variables for the three treatment conditions and the control group are shown in Table 9. The mean for Writing, the conceptual knowledge measure, was highest for the Observe + Texts treatment group (M=4.64), followed by the Texts Only treatment group (M=3.85). The Observe Only treatment group (M=2.71) and Control group (M=2.77) had similar means, which were lower than the other two treatment groups. For Situation Interest1 and Situation Interest2 measures, the mean for the Observe + Texts treatment condition was M=7.0 for Situation Interest1 and M=4.88 for Situation Interest2, which exceeded the means for Observe Only: M=6.28 for Situation Interest1 and M=4.26 for Situation Interest2. Texts Only: M=6.36 for Situation Interest1 and M=3.85 for Situation Interest2, and the Control group: M=3.02 for Situation Interest1 and M=2.95 Situation Interest2. The Intrinsic Motivation measure was similar for all four groups, with the Observe + Texts treatment condition (M=36.83), slightly higher than the other two treatment conditions and the control group: Observe Only (M=35.47), Texts Only (M=35.07), and the Control group (M=35.00). The Topic Interest measure, however, was higher for the Observe + Text treatment condition (M=27.54), than the other two treatment conditions and the control group: Observe Only (M=26.47), Texts Only (M=24.43), and the Control group (M=22.56).
Table 9

Means and Standard Deviations for the Three Treatment Groups and Control Group

<table>
<thead>
<tr>
<th></th>
<th>Observe = Texts (n=42)</th>
<th>Observe Only (n=42)</th>
<th>Texts Only (n=41)</th>
<th>Control Group (n=44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
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<tr>
<td>MAT</td>
<td>39.16</td>
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<td>6.21</td>
<td>3.60</td>
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<td>.96</td>
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<td>Write</td>
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<td>1.60</td>
<td>2.71</td>
<td>1.11</td>
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<td>Intrinsic Motivation</td>
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<td>4.82</td>
<td>35.47</td>
<td>5.37</td>
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<tr>
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<td>27.54</td>
<td>3.81</td>
<td>26.47</td>
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<td>Reading Efficacy</td>
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<td>15.40</td>
<td>2.61</td>
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</table>

Note. No. of cases: 169.

Key. MAT = Metropolitan Achievement Test and Prior = prior knowledge/pretest measures; Interest 1 = Monday’s measure of situational interest; Interest 2 = Wednesday’s measure of situational interest; Question 1 = average quality of questions, Question 2 = total number of questions; Draw and Write = conceptual knowledge measures; Intrinsic Motivation, Topic Interest, and Reading Efficacy = Motivation factors.
The correlations among all of the dependent and independent variables are shown in Table 10. It can be noticed that prior knowledge and MAT correlated \( r = .44; p < .001 \), showing that these two covariates were associated. Writing correlated substantially with drawing \( r = .56; p < .001 \). Writing also correlated substantially with prior knowledge \( r = .41; p < .001 \), but not significantly with MAT \( r = .31 \). Writing was, however, correlated significantly with Interest2 \( r = .19; p < .01 \). It is interesting to note that Drawing correlated significantly with Prior Knowledge \( r = .23; p < .01 \), as well as with MAT \( r = .35; p < .001 \).

Topic Interest, an important outcome variable, correlated significantly with Intrinsic Motivation \( r = .47; p < .001 \). Topic Interest also correlated significantly with Interest2 \( r = .42; p < .001 \), Draw \( r = .19; p < .01 \), and MAT \( r = .17; p < .05 \). Reading Efficacy, another outcome variable, correlated significantly with Topic Interest \( r = .23; p < .05 \). Reading Efficacy also correlated significantly with Intrinsic Motivation \( r = .31; P < .001 \), Prior Knowledge \( r = .23; p < .05 \), and MAT \( r = .34; P < .001 \), but not with any other variables. Interest2, an outcome variable, correlated significantly with Interest1 \( r = .15; p < .05 \) and Intrinsic Motivation \( r = .29; p < .001 \). Interest2 was also correlated significantly with Write \( r = .19; p < .001 \), and with MAT \( r = .16; p < .05 \).

Neither of the Questioning measures correlated significantly with other variables. Question1, however did correlate highly with Question2 \( r = .96; p < .001 \). The pattern of correlations is similar for both Question1 and Question2 measures in relation to the other variables, which was consistent.
Table 10

Correlations Among Dependent Measures and Covariates for all Students

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<td>.15*</td>
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<td>6. Question2</td>
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<td>-.04</td>
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<td>7. Draw</td>
<td>.35***</td>
<td>.23**</td>
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<td>---</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Write</td>
<td>.31</td>
<td>.41***</td>
<td>.56***</td>
<td>.19**</td>
<td>.02</td>
<td>.07</td>
<td>.56***</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Intrinsic Motivation</td>
<td>-.11</td>
<td>-.11</td>
<td>.03</td>
<td>.29***</td>
<td>-.04</td>
<td>-.03</td>
<td>.01</td>
<td>.03</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>10. Topic Interest</td>
<td>.17*</td>
<td>-.01</td>
<td>.13</td>
<td>.42***</td>
<td>-.10</td>
<td>-.07</td>
<td>.19**</td>
<td>.20</td>
<td>.47***</td>
<td></td>
</tr>
<tr>
<td>11. Reading Efficacy</td>
<td>.34***</td>
<td>.23*</td>
<td>-.02</td>
<td>.13</td>
<td>-.03</td>
<td>-.02</td>
<td>.06</td>
<td>.13</td>
<td>.31***</td>
<td>.23*</td>
</tr>
</tbody>
</table>

Note. No. of cases: 169 2-tailed Significance: *p<.05  **p<.01  ***p<.001.

The remaining results are organized to correspond to the four research questions.

Question #1 was. "To what extent do science observation or interesting texts reading separately increase interest, motivations to read, and conceptual learning from text; does the combination of science observation and interesting texts reading create a
statistically significant interaction?" To examine the effects of science observation and interesting texts on intrinsic motivation and conceptual knowledge, while controlling for background variables, the mean differences between the four treatment conditions on Write, the conceptual knowledge measure were examined first. The other conceptual knowledge measure, Draw, was highly correlated with Write ($r=.56, p<.001$), so this measure was dropped. These differences are presented in Table 11.

Table 11

Means of Cells and Main Effects on Write

<table>
<thead>
<tr>
<th></th>
<th>Texts</th>
<th>No Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observe</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M=4.64 (n=42)</td>
<td>M=2.71 (n=42)</td>
</tr>
<tr>
<td>Observe+ Texts</td>
<td>Observe Only</td>
<td></td>
</tr>
<tr>
<td>No Observe</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M=3.85 (n=41)</td>
<td>M=2.77 (n=44)</td>
</tr>
<tr>
<td>Texts Only</td>
<td>Control Group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M=4.25 (n=83)</td>
<td>M=2.74 (n=86)</td>
</tr>
</tbody>
</table>

Note: No. of cases: 169

To analyze the data, an analysis of covariance (ANCOVA) was conducted with Write as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance, with standardized reading achievement test scores
(MAT) and prior knowledge as covariates. This analysis yielded results presented in Table 12. The column labeled 'Write' in Table 12 shows the steps in the analysis of covariance. The two covariates combined were statistically significant, $F(2, 159) = 19.56, p < .001$. The main effect for Text was also statistically significant, $F(1, 159) = 56.39, p < .001$. However, the main effects for Observe and Gender were not statistically significant. These results show that the Interesting Texts condition increased conceptual learning from text, but the Observe condition did not increase conceptual learning from text when previous reading achievement was controlled. Note that the interaction of Interesting Texts and Science Observation was statistically significant.

Table 12

Analysis of Covariance of Independent Variables on Write, Topic Interest, Reading Efficacy, and Situation Interest2

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Write DF</th>
<th>Write F</th>
<th>Write SigF</th>
<th>Topic Interest DF</th>
<th>Topic Interest F</th>
<th>Topic Interest SigF</th>
<th>Reading Efficacy DF</th>
<th>Reading Efficacy F</th>
<th>Reading Efficacy SigF</th>
<th>Situation Interest2 DF</th>
<th>Situation Interest2 F</th>
<th>Situation Interest2 SigF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within + Residual</td>
<td>159</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regression</td>
<td>2</td>
<td>19.56</td>
<td>.001***</td>
<td>1.72</td>
<td>.182</td>
<td>.190***</td>
<td>12.77</td>
<td>.001***</td>
<td>.90</td>
<td>.409</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text</td>
<td>1</td>
<td>56.39</td>
<td>.001***</td>
<td>3.99</td>
<td>.047*</td>
<td>.38</td>
<td>.536</td>
<td>10.12</td>
<td>.002**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observe</td>
<td>1</td>
<td>2.57</td>
<td>.111</td>
<td>19.48</td>
<td>.001**</td>
<td>.39</td>
<td>.533</td>
<td>24.17</td>
<td>.001***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>.43</td>
<td>.511</td>
<td>1.71</td>
<td>.192</td>
<td>2.36</td>
<td>.126</td>
<td>5.13</td>
<td>.025*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text x Observe</td>
<td>1</td>
<td>4.73</td>
<td>.031*</td>
<td>.19</td>
<td>.660</td>
<td>.07</td>
<td>.791</td>
<td>.35</td>
<td>.554</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text x Gender</td>
<td>1</td>
<td>.00</td>
<td>.958</td>
<td>2.24</td>
<td>.416</td>
<td>.24</td>
<td>.624</td>
<td>.60</td>
<td>.439</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observe x Gender</td>
<td>1</td>
<td>.29</td>
<td>.590</td>
<td>.08</td>
<td>.781</td>
<td>.35</td>
<td>.555</td>
<td>.95</td>
<td>.332</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Text x Observe x Gender</td>
<td>1</td>
<td>.02</td>
<td>.889</td>
<td>.07</td>
<td>.791</td>
<td>7.39</td>
<td>.007**</td>
<td>.00</td>
<td>.998</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: No. of cases: 169. * p < .05  ** p < .01  *** p < .001*
To address the issue of student motivation, including student interest, in Question #1, the mean effect of the treatment conditions on Topic Interest and Reading Efficacy were examined. The motivation factor titled Intrinsic Motivation yielded no statistically significant effects, so this factor of motivation was dropped. In terms of interest, Situational Interest2 was also examined. Situational Interest1 was also dropped because Situational Interest2 resulted in a stronger indicator of situational interest. The means on Topic Interest, a factor of motivation, are presented in Table 13.

Table 13
Means of Cells and Main Effects on Topic Interest

<table>
<thead>
<tr>
<th></th>
<th>Texts</th>
<th>No Texts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observe</strong></td>
<td>M=27.55 (n=42)</td>
<td>M=26.48 (n=42)</td>
<td>M=27.01 (n=84)</td>
</tr>
<tr>
<td></td>
<td>Observe + Texts</td>
<td>Observe Only</td>
<td></td>
</tr>
<tr>
<td><strong>No Observe</strong></td>
<td>M=24.44 (n=41)</td>
<td>M=22.57 (n=44)</td>
<td>M=23.47 (n=85)</td>
</tr>
<tr>
<td></td>
<td>Texts Only</td>
<td>Control Group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M=26.01 (n=83)</td>
<td>M=24.48 (n=86)</td>
<td></td>
</tr>
</tbody>
</table>

*Note: No. of cases: 169*

To analyze the data on students' motivation, an analysis of covariance (ANCOVA) was conducted with the motivational factor of Topic Interest as the
dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance with standardized reading achievement test scores (MAT) and prior knowledge as covariates. This analysis yielded statistically significant effects. The results are presented in Table 12. The two covariates combined were not statistically significant. The main effect for Text was statistically significant. \( F(1, 159) = 3.99, p<.05 \). The main effect for Observe was also statistically significant. \( F(1, 159) = 19.48, p<.001 \). The main effect for Gender, however, was not statistically significant.

An analysis was conducted with the motivation factor of Intrinsic Motivation as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance (ANCOVA) with standardized reading achievement test scores (MAT) and prior knowledge as covariates. This analysis yielded no statistically significant effects, and therefore this motivation factor was dropped.

The third motivation factor, Reading Efficacy, was also analyzed. The means for each treatment condition, including gender differences, are shown in Table 14. The data were analyzed using an analysis of covariance (ANCOVA) with Reading Efficacy as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance, with standardized reading achievement test scores (MAT) and prior knowledge as covariates. The results of this analysis are shown in Table 12. The two covariates combined were statistically significant, \( F(2, 159) = 12.77, p<.001 \). There were no statistically significant main effects: there were no statistically significant two-way interactions. There was, however, a statistically significant three-way interaction between Text and Observe and Gender. \( F(1, 159) = 7.39, p<.007 \). Table 15 shows the
mean differences for boys and girls in each of the three treatment conditions and the control group. The main effects for Text, Observe, and Gender are presented. The mean for those students who observed (M=15.28, n=85) was very similar to the mean for those students who did not observe (M=15.44, n=84). The mean for the students with interesting texts (M=15.27, n=83) was almost identical to the mean for the students with no interesting texts (M= 15.26, n=86). Likewise, the mean for the boys (M=15.56, n=84) was similar to the mean for the girls (M=15.16, n=85), showing no statistically significant differences. The three-way interaction shows that interesting texts facilitated performance for boys in the No Observe condition, but Interesting Texts reduced performance for boys in the Observe condition. The opposite pattern appeared for girls. Interesting Texts facilitated performance for girls in the Observe condition, but Interesting Texts reduced performance for girls in the No Observe condition. Possible interpretations will be presented in the Discussion.
Table 14

Cell Means and Main Effects for Independent Variables on Reading Efficacy

<table>
<thead>
<tr>
<th>Observations</th>
<th>Texts</th>
<th>No Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td><strong>Observe</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M=15.15</td>
<td>15.77</td>
<td>15.96</td>
</tr>
<tr>
<td>(n=20)</td>
<td>(n=22)</td>
<td>(n=24)</td>
</tr>
<tr>
<td>Observe + Texts</td>
<td>Observe Only</td>
<td>Observe Only</td>
</tr>
<tr>
<td><strong>No Observe</strong></td>
<td>M=16.44</td>
<td>M=14.70</td>
</tr>
<tr>
<td>(n=18)</td>
<td>(n=23)</td>
<td>(n=22)</td>
</tr>
<tr>
<td>Texts Only</td>
<td>Control Group</td>
<td>Control Group</td>
</tr>
<tr>
<td>M=15.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys: M=15.56</td>
<td></td>
<td>Girls: M=15.16</td>
</tr>
<tr>
<td>(n=84)</td>
<td></td>
<td>(n=85)</td>
</tr>
</tbody>
</table>

Note. No. of cases: 169

To examine student interest, an analysis of covariance (ANCOVA) was conducted with Situation Interest2 as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance, with standardized reading achievement test scores (MAT) and prior knowledge as covariates. The results are presented in Table 12. The two covariates combined did not yield a statistically significant effect. However, there were three statistically significant main effects for this
analysis. The means for each treatment condition are presented in Table 15. The main effect for Text was statistically significant. $F(1. 159) = 10.12$. $p<.002$. The main effect for Observe was statistically significant. $F(1. 159) = 24.17$: $p<.001$. In addition, the main effect for Gender was statistically significant. $F(1. 159) = 5.13$. $p<.05$. There were no statistically significant interactions.

Table 15

**Cell Means and Main Effects for Independent Variables on Situation Interest2**

<table>
<thead>
<tr>
<th></th>
<th>Texts</th>
<th>No Texts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td><strong>Observe</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observe+Texts</td>
<td>M=4.80</td>
<td>M=4.95</td>
</tr>
<tr>
<td></td>
<td>(n=20)</td>
<td>(n=22)</td>
</tr>
<tr>
<td>Observe Only</td>
<td>M=3.56</td>
<td>M=4.09</td>
</tr>
<tr>
<td></td>
<td>(n=18)</td>
<td>(n=23)</td>
</tr>
<tr>
<td><strong>No Observe</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texts Only</td>
<td>M=4.37</td>
<td>M=3.59</td>
</tr>
<tr>
<td></td>
<td>(n=83)</td>
<td>(n=86)</td>
</tr>
<tr>
<td>Controls Only</td>
<td>Boys: M=3.70</td>
<td>Girls: M=4.25</td>
</tr>
<tr>
<td></td>
<td>(n=84)</td>
<td>(n=85)</td>
</tr>
</tbody>
</table>

*Note.* No. of cases: 169
To address the second portion of Question #1 on conceptual knowledge, an analysis of covariance (ANCOVA) was conducted with Write as the dependent variable. The analysis consisted of the previously reported 2 (text) by 2 (observer) by 2 (gender) analysis of covariance, with standardized reading achievement test scores (MAT) and prior knowledge as covariates (see Table 12). The important information for this question is the statistically significant interaction of Text and Observe. F(1, 159) = 4.73, p<.05. The pattern of effects can be observed in Table 11. The mean of the Observe + Texts treatment group was higher (M=4.64) than the other two treatment groups and the control group: Texts Only (M=3.85), Observe Only (M=2.71), and the Control group (M=2.77). A post hoc analysis was conducted to see if differences between the three treatment conditions and the control group were statistically significant. According to a Bonferroni post hoc contrast, the difference between Observe + Texts (M=4.64) and Texts Only (M=3.85) was statistically significant at the p<.05 level. The Observe + Texts group was also different from Observe Only (M=2.71) and the Control group (M=2.77) at the p<.05 level. The difference between Texts Only (M=3.85) and Observe Only (M=2.71) was statistically significant at the p<.05 level, and different from the Control group (M=2.77). The difference between Observe Only (M=2.71) and the Control group (M=2.77) was not statistically significant. Figure 1 shows the important interaction of Interesting Texts and Science Observation.
This interaction can be interpreted by stating that the contribution of interesting texts to conceptual learning was greater if students observed than if they did not observe. In other words, combining interesting texts with science observation yielded more conceptual knowledge gains than any other condition.

The motivation aspect for the second portion of Question #1 was also analyzed. To address this portion, an analysis of covariance (ANCOVA) was conducted with the motivation factor of Topic Interest as the dependent variable. The previously conducted
2 (text) by 2 (observe) by 2 (gender) analysis of covariance with standardized reading achievement test scores (MAT) and prior knowledge as covariates was used. The results of this analysis are presented in Table 12. There were no statistically significant interactions.

Question #2 was, "To what extent does situated interest mediate the effects of science observation and reading interesting texts on conceptual learning from text?"

This question was addressed by using Situation Interest2 as an additional covariate in the analysis of the effects on conceptual knowledge. An analysis of covariance was conducted with Write as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance. The standardized reading achievement test scores (MAT) and prior knowledge were used as covariates. Situation Interest2 was added as a third covariate. The results of this analysis are presented in Table 16. The three covariates combined were statistically significant. $F(3, 158) = 12.96, p < .001$. The main effect for Text was statistically significant. $F(1, 158) = 54.45, p < .001$. The main effects for Observe and Gender were not statistically significant. The interaction between Text and Observe was statistically significant. $F(1, 158) = 4.71, p < .03$. There were no other statistically significant interactions.

This result leads to the conclusion that was found in the previous analysis shown in Table 12. The statistically significant main effects were not changed when Situation Interest2 was added as a third covariate. The statistically significant main effect of Text on Write (conceptual knowledge) and the statistically significant interaction of Text and Observe on Write were observed even when Situation Interest2 was controlled.
Therefore, these effects were not simply attributable to the effects of the variables on situation interest.

Table 16

Analysis of Covariance of Independent Variables on Write and Topic Interest with MAT, Prior Knowledge, and Situation Interest2 as Covariates

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>DF</th>
<th>Write</th>
<th></th>
<th>Topic Interest</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>F</td>
<td>Sig of F</td>
<td>F</td>
<td>Sig of F</td>
</tr>
<tr>
<td>Within + Residual</td>
<td>158</td>
<td></td>
<td></td>
<td>158</td>
<td></td>
</tr>
<tr>
<td>Regression</td>
<td>3</td>
<td>12.96</td>
<td>.001***</td>
<td>3</td>
<td>6.05</td>
</tr>
<tr>
<td>Text</td>
<td>1</td>
<td>52.45</td>
<td>.001***</td>
<td>1</td>
<td>1.19</td>
</tr>
<tr>
<td>Observe</td>
<td>1</td>
<td>2.15</td>
<td>.145</td>
<td>1</td>
<td>8.42</td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>.40</td>
<td>.526</td>
<td>1</td>
<td>.45</td>
</tr>
<tr>
<td>Text x Observe</td>
<td>1</td>
<td>4.71</td>
<td>.032*</td>
<td>1</td>
<td>.08</td>
</tr>
<tr>
<td>Text x Gender</td>
<td>1</td>
<td>.00</td>
<td>.955</td>
<td>1</td>
<td>1.17</td>
</tr>
<tr>
<td>Observe x Gender</td>
<td>1</td>
<td>.28</td>
<td>.596</td>
<td>1</td>
<td>.00</td>
</tr>
<tr>
<td>Text x Observe x Gender</td>
<td>1</td>
<td>.02</td>
<td>.890</td>
<td>1</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note: No. of cases: 169. * p < .05  ** p < .01  *** p < .001

Question #2 was also examined in terms of motivation. An analysis was conducted with Topic Interest as the dependent variable. The analysis was a 2 (text) by 2 (observe) by 2 (gender) analysis of covariance. The standardized reading achievement test scores (MAT) and prior knowledge were used as covariates. Situation Interest2 was added as a third covariate. The results are shown in Table 16. The three covariates combined were statistically significant. F(3, 158) = 6.05, p<.001. The main effect for Text was not statistically significant. The main effect for Observe was statistically
significant. \(F(1, 158) = 8.42, p<.004\). The main effect for Gender was not statistically
significant. There were no statistically significant interactions.

Comparing this analysis to the analysis in Table 12, the main effect of Observe
was the same in Table 16 as in Table 12. However, the statistically significant Text
effect appeared in the first analysis in Table 12, but not in the second analysis in Table 16.
The effect of Text on Topic Interest was removed when Situation Interest2 was added
as a third covariate in the analysis. The effect of Text on Topic Interest was mediated
by Situation Interest2; but the text effect on Write was not mediated by Situation
Interest2. However, the effect of Observe showed a different pattern. Observe had a
statistically significant effect on Topic Interest irrespective of whether Situation Interest2
was involved in the analysis. This permits the inference that the Observe effect on Topic
Interest was not mediated by the immediate situation interest of students. This result will
be interpreted more fully in the Discussion.

Question #3 was, "To what extent does student questioning mediate the effects
of science observation and interesting text reading on conceptual learning from text?"
To examine this question, an analysis of covariance (ANCOVA) was conducted with
Write as the dependent variable. The analysis contained 2 (text) by 2 (observe) by 2
(gender) analysis of covariance. The standardized reading achievement test scores
(MAT), prior knowledge, and Situation Interest2 were used as the three covariates. This
analysis yielded no statistically significant effects. The results can be seen in the
correlation matrix in Table 10. The two question variables did not correlate with any
outcome variables, so the results of the analysis were consistent.
CHAPTER V

Discussion

Synthesis of Findings

The manipulation of science observation and interesting texts in this study yielded many important findings in terms of motivations to read and conceptual knowledge gained within a life science domain when controlling for previous reading achievement. There were three indicators of motivation in this study: (a) topic interest, which was considered a personal interest in the topic of life cycles and habitats of crabs and turtles. (b) situational interest, which was considered interest in the specific, daily instructional activities. and (c) reading efficacy, which was considered students’ general beliefs about their own reading ability.

Effects of science observation and reading interesting text on motivation factors. The results in terms of these three factors of motivation were as follows. First, students’ topic interest was affected through the use of interesting texts. A statistically significant text effect on topic interest occurred after previous reading achievement was controlled. Students who read interesting texts had higher topic interest than students who did not read interesting texts. In addition, the science observation condition also had an effect on topic interest. There was a statistically significant science observation effect on topic interest when previous reading achievement was controlled. Students who observed live hermit crabs and turtles had higher topic interest than students who did not observe.
The second motivation factor was **situational interest**. The same pattern of interesting texts and science observation effects occurred for situational interest as for topic interest. Students who read interesting texts had higher situational interest than the students who did not read interesting texts, once previous reading achievement had been controlled. Likewise, students who observed live animals had higher situational interest than the students who did not observe, again controlling for previous reading achievement. The active involvement with the live animals provided immediate, compelling, and memorable sensory experiences. These experiences, in turn, created both a spontaneous, situational interest in crabs and turtles, as well as a personal, intrinsic motivation to learn about crabs and turtles. In addition, there was an effect for gender on **situational interest**. Girls had a higher level of situational interest than boys.

Finally, the third motivation factor was **reading efficacy**. There were no differences between the four treatment conditions in respect to reading efficacy, when previous reading achievement was controlled. Neither interesting texts nor science observation conditions influenced reading efficacy in one condition more than another. This meant that the students who were randomly assigned to the four treatment groups, all had similar reading efficacy, regardless of their general reading achievement and prior knowledge.

**Effects of science observation and interesting texts on conceptual knowledge.** This study also examined the effects of interesting texts and science observation on **conceptual knowledge** gained from text. In terms of conceptual knowledge, there was a statistically significant text effect on conceptual knowledge, when previous reading
achievement and prior knowledge were controlled. The use of interesting texts increased the level of conceptual knowledge gained from text. Students who read interesting texts gained more conceptual knowledge than the students who did not read interesting texts. The interesting texts provided students with multiple sources of information about crabs and turtles. The interesting texts booklet had colored photographs of many kinds of crabs and turtles. There were many text levels to accommodate students various reading abilities. Two groups of students did not have access to interesting texts. One group read their regular classroom textbook, which had extremely limited information: the second group read no text at all.

Science observation did not have an effect on conceptual knowledge. So students who only observed live animals did not gain any more knowledge than the students who did not observe (e.g., the control group). Students who only observed were motivated, yet they were uninformed.

Interaction effect on conceptual knowledge. When science observation and interesting texts were combined, there was a statistically significant interaction effect on conceptual knowledge when reading achievement and prior knowledge were controlled. This interaction meant that the students who read interesting texts in addition to science observation, gained more conceptual knowledge than the students who only read interesting texts, a regular science textbook, or only conducted science observation. The combination of science observation and interesting texts yielded statistically significantly higher conceptual knowledge gains than the other three conditions. The combination of science observation and interesting texts was also statistically
significant when situational interest was controlled in addition to previous reading achievement and prior knowledge. The combination of observation and interesting texts on conceptual knowledge was not mediated by situational interest. This combination resulted in a general, personal interest to read and learn about the topic of crabs and turtles. So while the science observation may have created a spontaneous interest in the topic, the combination of interesting texts to support this science observation created a general, personal motivation to gain knowledge about crabs and turtles.

The theoretical explanation for this interaction is that the two variables of science observation and interesting texts are synergistic. These variables set off a circular pattern of knowledge growth, continuing in an upward spiral that mutually affected each other. When the two factors of science observation and reading interesting text were present, a reciprocal relationship was formed. Students observed live animals, which caused them to wonder and think about what they saw. This created a process of self-questioning, which lead to a desire to find answers. The interesting texts provided the means to answer the questions generated by the observation and involvement with the animals. Once students began to read and search for knowledge about their questions and ideas, they thought of more questions. These questions, again, lead to further observation, reading and comprehending, and the cycle continued.

When children observe live animals without interesting, relevant texts, their questions remain unanswered, and no new knowledge is gained. Even though students
are aroused by observing live animals. They will remain uninformed without texts. The arousing effect of the observation will eventually fade. Likewise, when children only have interesting texts, they are bound to the information contained within them. Once students answer the questions they have from reading the interesting texts, they stop asking questions. Students become saturated by the information bound within the text. Without observation, the knowledge is limited and the arousal of the interesting text also fades. The combination of these factors resulted in not just additive, but exponential effects of knowledge gain. This exponential effect was the result of the reciprocity these two dynamic factors created. Their synergistic relationship continued to expand each other. These findings have importance in the field of education and extend current research into new areas. This study is original in its attempt to explore the relationships of science observation and expository text reading within a controlled context.

A three-way interaction occurred between interesting texts, science observation, and gender on reading efficacy. When the boys were in the No Observe conditions, the interesting texts facilitated performance. However, when boys were in the Observe condition, the interesting texts reduced their performance. The opposite pattern was true for girls. When girls were in the Observe condition, the use of interesting texts facilitated their performance. But when girls were in the No Observe condition, the interesting texts reduced performance.

Gender was included in the analysis because of the common practice of comparing girls to boys in school achievement (Asher, 1980), as well as gender
differences common in motivation factors (Asher, 1980; Wigfield, 1997). Asher (1980) states that children’s interests may in fact be sex-typed, yet there is also considerable variability within-sex types. Asher states that this variability means that providing different passages to boys and girls can lead to considerable experimental error.

In three studies with fifth- and sixth-grade students, examining the relationship of reading comprehension and interest in a topic, Asher (1980) found that students had greater desire to read passages in which they were interested. Also, students’ comprehension was higher on high-interest topics. In terms of gender differences, in two of the studies (Asher & Geraci, 1980: Asher & Markell, 1974), boys’ performance was facilitated more than girls’ performance when they read high-interest text.

This interpretation may offer some insight into this three-way interaction, although a thorough interpretation of these effects may be beyond the scope of this study. A theoretical explanation would require additional investigation. Also, there were no gender effects among the four treatment conditions in respect to Reading Efficacy, meaning that there were no significant gender differences among the four treatment conditions.

The relationship of this study to previous literature in the field of reading and science will be discussed next.

Relation to Previous Literature

Confirming previous literature. This study confirms important aspects of previous research conducted in the field of reading with respect to motivation and
classroom conditions that promote intrinsic motivations to read and student achievement. Specifically, this study stems from and confirms recent work done by Guthrie, Van Meter, McCann, Anderson et al. (1996), and Guthrie et al. (in press) in which Concept-Oriented Reading Instruction (CORI) influenced student motivation and conceptual knowledge gained from expository text. This study examined a language-arts-science program, which emphasized science observations, student self-direction, strategy instruction, collaborative learning, conceptual themes, and coherence of literacy learning experiences. Expository trade books replaced reading basals and textbooks. According to a one-week performance assessment in the fall and spring, students gained in the following higher order strategies: searching multiple texts, representing conceptual knowledge through drawing and writing, and comprehending informational text. All students who increased in intrinsic motivation also increased in their use of higher order strategies. When students are motivated to read for the sake of learning, intrinsic motivations activate the self-regulation of higher order strategies for learning through reading and writing (Dole et al., 1991; Wade, 1992).

Reading about concepts and then explaining this knowledge gained from text can help students gain deeper conceptual knowledge. Chi and her colleagues (1994) found that students who were prompted to explain their ideas and make explanations of questions based on text, gained deeper conceptual knowledge from text than those who did not explain. Students in the Chi et al. (1994) represented their knowledge of the human circulatory system by drawing a graphic representation of how the circulatory system works, and then explained how this system works in writing. The current study
asked students to represent their knowledge of crabs and turtles in the same way as the Chi et al. study. First students were asked to draw a picture of how crabs and turtles live and grow. Next, students were asked to explain in writing how crabs and turtles live and grow. This method of knowledge representation was also used in the CORI research (Guthrie, Van Meter, McCann, Wigfield, et al., 1996; Guthrie et al., in press), and proved to be an effective way for students to express their knowledge. Students in the current study who read interesting texts gained more conceptual knowledge than students who did not read interesting texts. However, students who observed live animals in addition to reading interesting texts gained more conceptual knowledge than the other three conditions. Students’ conceptual knowledge in the Chi et al., (1994), the Guthrie, Van Meter, McCann, Wigfield, et al., (1996), Guthrie et al., (in press), and the current study, were all measured on the same type of conceptual knowledge scale.

The current study also confirms research conducted on motivations for students to gain conceptual knowledge from text. This study confirms research done by Pintrich, Marx, and Boyle (1993), which found that when students are extrinsically motivated, and their motivation to read is to complete an assignment or get a good grade (e.g., extrinsic), their knowledge tends to be more verbatim or rote, rather than gaining fully integrated or conceptual knowledge. In the current study, the control group did not have interesting texts or live animals to observe. This instructional condition may have been less motivating for some students. Consequently, the knowledge many students in this group gained was verbatim and declarative, rather than systemic and conceptual. On the other hand, students who were motivated, were challenged by the task and
gained knowledge about crabs and turtles. Dweck and Leggett (1988) defined learning goals as the seeking of challenging tasks and the maintenance of effective striving under failure. Students with learning goals choose learning tasks that are challenging; these students want to learn for the sake of learning. In the current study, students who were possessed goals to learn, or who were motivated, gained more conceptual knowledge about crabs and turtles than students who did not possess goals for learning, or who were not motivated. This was true regardless of the student’s treatment condition. There were students in the three “text” treatment conditions, who persisted to search for information about crabs and turtles in spite of instructional conditions (e.g., lack of information). These students all gained knowledge about crabs and turtles.

In addition to motivation, conceptual knowledge is also influenced by topic-based interest (Alexander, Kulikowich, & Jetton, 1994). As described in detail in Chapter II, when students are interested in a topic, they read more about it, thus gaining more knowledge. Interest in a topic enhances the amount, depth, and fullness of conceptual learning from a text about that topic (Alexander, Kulikowich, & Jetton, 1994). The current study confirms research conducted by Alexander and her colleagues. Students who were interested in crabs and turtles read about them and ultimately gained conceptual knowledge about the topic. Students in the Observe + Interesting Texts condition gained more conceptual knowledge than the other three groups because this interest in the topic of crabs and turtles continued to regenerate and expand.
The current study also confirms work done by Hidi and Anderson (1992) in which students who found texts interesting gained more conceptual knowledge. However, in their study of fourth and sixth grade students, Hidi and Anderson did not control for previous reading achievement or prior knowledge on the topics the students read about. Schiefele (1992) conducted a study on students' interest and comprehension of text for college students and found that when students found the text to be interesting, this interest invoked feelings of enjoyment, involvement, and personal importance, which in turn, increased conceptual understanding of the text.

This study also confirms previous research in respect to instructional contexts that promote intrinsic motivations to read and gain knowledge from text. Ames's (1992) TARGET structure for instruction which provides a framework that integrates strategies to promote mastery (e.g., learning) goal orientations in the classroom, is confirmed by this study. One of the six classroom dimensions that Ames claimed can be structured to emphasize mastery goal orientations is the task. The Task refers to design of learning activities, tasks, and assignments. She claimed these tasks need to be interesting, challenging, and provide students with variety. Designing tasks also includes helping students set realistic goals and ways to organize and manage the steps to reaching those goals. The purpose of these tasks is to increase interest in learning as well as the quality of engagement. Ames, however, does not include science observation as one of those classroom factors, although science observation could be included under interesting tasks or activities that promote engagement. The current
study confirms the fact that these important classroom factors do promote goals for learning, which may also enhance motivations or engagement in learning.

In addition to Ames' (1992) classroom factors, a review of instructional context variables that enhance students' goals for learning, was done by Stipek (1996). In her review, Stipek claimed that to foster students' learning goals, instruction should include opportunities to demonstrate mastery and be adapted to student's knowledge, understanding, and personal experience. In other words, instruction should be relevant to their lives. Teachers should also include opportunities for discovery and experimentation and success should be defined in terms of improvement. Effort, learning, and working hard should be emphasized rather than getting the right answer or out performing others. These instructional factors mirror some of Ames's suggestions as ways to enhance students' motivation. The current study confirms that important classroom factors such as engaging and meaningful activities with personal relevance, discovery and experimentation, as well as challenge and a focus on mastery or learning versus performance are in fact, motivating and increase student achievement.

In addition to CORI (Guthrie, Van Meter, McCann, Wigfield, et al., 1996), TARGET (Ames, 1992), and Stipek's (1996) review of instructional contexts that enhance student motivation and achievement, Bruning and Schweiger (1997) investigated the integration of science and literacy experiences to motivate student learning. In their study of elementary students, Bruning and Schweiger created a program called Explorers. The Explorers program uses students' experiences in nature to energize literacy development. The goals of the Explorers program include
increasing students' motivation for learning, improving students' literacy skills, helping students work cooperatively, and developing students' science expertise. These four goals are met in similar ways to the instructional features of CORI (Guthrie, Van Meter, McCann, Wigfield, et al., 1996), including strategy instruction, student autonomy, science observation which capitalizes on student interest, mastering goals, interesting texts, and social interaction and collaboration. In addition to nature excursions in which students catch tadpoles from a pond and observe other forms of wildlife and insects, students in the Explorers program are also provided a variety of interesting texts (Schraw et al., 1995), as in the CORI program. In their study of fifth- and sixth-grade students, Bruning and Schweiger found that these factors contribute to student motivation and promote life-long learners. The current study confirms that these instructional factors of science observation and interesting text reading may enhance different factors of motivation and interest. These motivational factors (e.g., reading efficacy or topic interest), and access to interesting and informative books, is the first step in a lifetime of learning. When books are relevant to meaningful tasks that have personal meaning to students, and are readily available, "even the most reluctant literacy learner is likely to become interested in them" (Bruning & Schweiger, 1997, p. 165).

Unique ness of the current study. Previous research in the field of science has failed to examine the effects of expository text in addition to science activities, namely hands-on activities, demonstrations, or simulations. I was even more hard-pressed to find empirical research on elementary children's science and literacy connections. Most
of the science research is focused on ages older than elementary. In the field of reading, there has been little research done that examines these two specific factors as important classroom characteristics to enhance student motivation and achievement. Only recently has research been done to examine these factors. As mentioned above, Bruning and his colleagues (1994, 1997; Schraw et al., 1995) have begun to examine science and literacy connections and within a meaningful and holistic instructional context as well. The current study was based on previous CORI research, as well as the Explorers program in which the two factors of science observation and interesting texts were carefully manipulated and analyzed. The results of the current study extend the CORI and Explorers program research to show that these two instructional factors are in fact, dynamic and statistically significant in terms of motivating elementary age students to read and to gain conceptual knowledge from expository text.

The results of this study also speak to the domain of science, making a valid case for the inclusion of texts. The current study found that pure science observation learning, without access to text, does not yield knowledge gains. Contrary to popular beliefs about pure science discovery learning, the observation and discovery is not inherently knowledge producing, at least not at a deep, systemic, conceptual level. Without informational books as resources to support discovery, only declarative levels of knowledge will be gained through observation. Curriculum integration can benefit students in numerous ways.

Another aspect of the current study that is unique is the fact that statistically significant results were obtained after only four days of treatment. This result shows
the amount of knowledge that children can gain when they are interested and motivated
to learn. There were specific classroom characteristics that were manipulated and the
classroom environment was created to enhance student motivation and achievement.
Teachers can be empowered when they realize that they can create classrooms that
promote student learning and motivations to read. There may be many more classroom
characteristics that foster students' motivations to read and conceptual knowledge from
text. This study was the first step in successfully designing a condition in which two
factors interacted to produce an effect.

Lastly, this study attempted to expose children to multiple, interesting texts, in
which to search for knowledge. In previous studies, searching for information has been
examined as an important strategy for gaining knowledge in complex documents
(Guthrie & Mosenthal, 1987), tables and graphs (Guthrie & Kirsch, 1987; Mosenthal,
1985), and textbook chapters (Byrnes & Guthrie, 1992; Dreher & Guthrie, 1991). A
model for search was developed by Guthrie and his colleagues (1991) and later revised
(Guthrie et al., 1993). Recently, Anderson and Guthrie (1997) extended this model for
search to include multiple texts and be extended for children in complex, search tasks
(Mosenthal, 1985). The current study provided children with a multi-text, complex
search task (Mosenthal, 1985) in which students were able to gain conceptual
knowledge from text. This strategy was an important step in gaining conceptual
knowledge about crabs and turtles. Students had to be able to select the text relevant to
the task, as well as be able to comprehend and integrate the information found in
multiple sections of the interesting texts booklet. The exposure to a multi-text, search
task was beneficial to students and provided them with practice in using important search strategies.

Mediating effects of situational interest on motivation and conceptual knowledge. In addition to the statistically significant effects of reading interesting texts and science observation on three aspects of motivation, there were important findings on topic interest when situational interest was controlled along with previous reading achievement and prior knowledge.

Science observation increased both topic interest and situational interest. However, science observation also increased topic interest at the end of the study when situational interest had been controlled. The observation had an effect on topic interest that was not mediated by situational interest. Observing live animals affected topic interest at a more general level that was not specific to the tasks or activities in the instruction. In other words, students who observed live animals were not just interested in the daily activities about crabs and turtles; they were motivated beyond these activities. Holding and interacting with live animals was exciting and stimulating for these students. Many students had never seen a live hermit crab or a live turtle before. Observing these crabs and turtles created interest about them. Students were interested in how they lived and what their unique characteristics were. However, student interest in these animals went beyond the daily task of observing them. These students became interested and motivated to learn about the domain of life science, namely the life cycles and habitats of crabs and turtles.
Interesting texts also increased topic interest and situational interest. Interesting texts, however, did not increase topic interest when situation interest was controlled. Therefore, the interesting text effect on topic interest was mediated by situational interest. The interesting text effect was limited to the text. Students’ interest was in the particular text, photographs, and information presented in the interesting text booklet. This interest was bound, or limited to, the text itself. The interesting texts aroused students’ interest in crabs and turtles, but this interest did not go beyond the text in the same way that the science observation did. Observing and interacting with live hermit crabs and turtles created a topic interest that resulted in a long-term commitment to learn about crabs and turtles. The experience of science observation is immediate and concrete. This sensory experience is on one end of a continuum where the symbols of language and literacy are on the other end. The direct, sensory experience is, perhaps, more memorable and easier to process than the abstractness of language, which takes effort and time to comprehend. Also, what is seen tends to be important and valuable (Standing, 1973). The book about crabs and turtles was inherently interesting, but the interest was limited to the information contained in that booklet. The language took time and effort to process and was more abstract than the science observation itself.

Limitations of the Study

There were certain classroom characteristics that were held constant for this experimental study, which limited the study in certain ways. These included instruction, materials, student collaboration and communication, and classroom
characteristics. All of the hypotheses of this study were conducted on intermediate age children, fifth graders. Also, there was only one instructor for all four groups in both schools. There was a separate room for the one-week intervention, which was separate from the students’ regular classroom activities. The sessions of instruction were only forty minutes for each group, each day. This time limit may have been too much for some groups, but not nearly enough time for other groups. For instance, the Observe + Interesting Texts treatment group could have worked for an hour per day for two weeks. On the other hand, the Control Group may have found all the information available in only two 40-minute sessions.

Other factors that were limiting in the study were the materials used, namely the texts. The interesting texts booklet was created to insure that all the students in the study had equal access to the same information. Ideally, students would have the actual trade books and would be able to choose a variety of books to search for information about crabs and turtles. In addition, students would have been subjected to the irrelevant information contained within each individual trade book. The interesting texts booklet used in the study was created from fourteen different expository trade books and the irrelevant information on bats and camels was included to provide verisimilitude to authentic trade books. But, these irrelevant sections were contrived and explicitly irrelevant to the topic of crabs and turtles (e.g., mammals vs. reptiles and crustaceans). Irrelevant information contained within the actual trade books may have been more subtle (e.g., fish vs. crustaceans) than the sections in the interesting texts booklet.
Also, the regular classroom science textbook used in the study was inherently limiting because it did not contain any information on crabs, and very limited information on turtles. The textbook did contain information on lobsters and crustaceans, but students would have to extrapolate this information to answer the question about crabs, which was also incomplete. In a typical classroom situation, if the textbook did not contain enough information, another resource could be utilized.

The third factor was student collaboration and communication. Each treatment group and the control group had a typical number of students for a regular classroom. The number of students in each group ranged from 20-24, which is typical, albeit less than average. Students sat at tables and were allowed to sit where they wanted. This study did not examine the social interaction of the students. Students were asked to work individually and were only allowed to formally share their knowledge with their peers on the last day of the treatment. All assessments were done on an individual basis. Students in the two science observation conditions were allowed to communicate more because the nature of science observation was inherently social. Students wanted to talk to each other about the animals and what they were discovering and observing. None of the students in any group was allowed to work with peers on a project or in a collaborative effort to answer the question for the week.

Another way this study was limiting was in terms of classroom characteristics. This study only examined two specific classroom characteristics: science observation and interesting texts. There are many more that were not examined. Other characteristics may have included strategy use, social interaction, self-direction, or self-
expression, to name a few. There are many classroom characteristics that may also enhance and foster students reading motivations and conceptual knowledge gains from expository text. This study showed the powerful combination of only two classroom characteristics, but there may be many more relationships to explore.

One of the research hypotheses was that student questioning would mediate the effects of science observation and interesting text reading on conceptual learning from text. Data analysis on this hypothesis yielded no significant effects. One reason for this result may have been the limited time involved in the instructional sessions. The treatment only lasted for four days. Students were given approximately ten minutes on the second day to write down their questions. This may have been an unreasonable request in an insufficient amount of time. A second reason may have been that the hypothesis was not tested well. Most of the students in all four groups had questions about their curiosities, the task, or what they were learning, but students were only given one explicit and directed opportunity to think about and write these questions in their logs. Students may have had questions every day of the treatment, but only one day’s questions were assessed.

**Future Research Questions**

The following are implications for future research. First, the age boundaries for fostering and promoting intrinsic motivations for reading and conceptual knowledge gains are unknown. This study showed that these factors are important in the fifth
grade, but primary and secondary students may also benefit from this combination of classroom characteristics.

Secondly, strategy instruction may interact with science observation in much the same way that interesting texts did. If students have access to interesting texts and this factor is held constant, it would be interesting to manipulate strategy instruction and science observation to explore this combination. This study leads to a follow-up study on the importance of instruction and searching for information in expository texts. Effective strategies for search may be an important and dynamic connection to science observation and interesting texts.

In addition to strategy use and explicit strategy instruction, social interaction should be investigated. It would be useful to study Brown's (1997) expectation that social interaction fosters knowledge gains from expository text. The factors of social collaboration and strategy use would be an interesting follow up to this study.

Finally, this intervention only lasted for four days. There were statistically significant increases in situational interest, topic interest, and conceptual knowledge gained from text. Would this interaction still occur in three months? What are the implications for long term motivations and conceptual knowledge gains?
APPENDIX A
Parent Consent Form

12 September, 1997

Dear Parents:

Your child’s fifth-grade class has been chosen to participate in a doctoral dissertation study for me and the University of Maryland in reading and science. The goal of the study is to see how much students can learn about a specific science topic during a one-week experiment involving science and reading. Your child will be randomly assigned to one group, where he/she will remain during the study.

The study will last for one week. The study will last for one week: October 10-17, 1997. Each study period will last for 40 minutes per day. On the first day of the study, your child will be given the Metropolitan Achievement Test to assess reading comprehension ability. Your child will also be given an assessment to test prior knowledge of the science topic. At the end of the week long study, your child will be asked to write about what he/she learned. Your child will also be asked to answer a reading motivation questionnaire that will ask his/her opinions about reading and his/her interest in the study. During the study, your child will be videotaped in a classroom setting. This procedure is to ensure that each group of students is treated fairly. The videotapes will not be used for any public use. To respect your privacy, your child’s name will be removed and a student identification number will be assigned. This will ensure that your child’s name and information will remain confidential. Participation in this study is voluntary; there will be no penalty if your child chooses not to participate. A copy of the assessments and questionnaire will be available for parents to view in the school’s office.

The information gathered from this study will be used solely by me for my doctoral dissertation. I am interested in the best ways children gain knowledge about a science topic involving reading and writing. This week of activities will be fun and exciting for your child. There will be no harm or danger that can occur to your child by participating in these activities. This study has been approved by the Prince George’s County Board of Education.

Please sign this letter at the bottom, giving permission for your child to participate in the study. Also, please read the “rules” of the study with your child. Have him/her sign their name in agreement to participating in the study and keeping the rules. If you have any questions, you may contact me at (301) 405-2827.

Thank you for your cooperation.

Sincerely,

Emily Anderson
University of Maryland, College Park

Principal’s Signature of Approval

Please detach this portion and return to your child’s teacher TOMORROW.

YES, I give permission for my child __________________________/Teacher’s name __________________________ to Participate in this research study. The activities will include testing, reading, writing, answering a questionnaire, and being videotaped. __________________________ (parent’s signature).

I __________________________ (child’s name) understand the rules of the study and agree to participate and keep the rules. __________________________ (child’s signature).

NO, I DO NOT give my permission for my child __________________________ to participate in this research study. The activities will include testing, reading, writing, answering a questionnaire, and being videotaped. __________________________ (parent’s signature).
APPENDIX A
Continued

Rules for Participating in the Research Study

This is a doctoral dissertation research study. To insure that the study remains honest and valid, I am asking students who choose to participate in the study to follow the following rules. Please read these with your child.

1. Students will be randomly assigned to one of four groups. Students will remain in this group for the entire week.
2. All students will be given an identification number that they are to use during the week on all papers and activities. This will help maintain privacy.
3. Students are to attend each day of the week.
4. Each study session will last 40 minutes per day.
5. Students are to work individually, unless asked to share with a group of students.
6. Students are not to discuss what they do in their group with members of other groups during the rest of the school day or during the week.
7. Students may not go to the library or ask parents or outside sources for ideas or help during the week.
8. All students will be learning about the same science concept and in the same room with the same teacher (which will be Miss Anderson).
9. All students will be videotaped in a group setting. These videotapes will not be used for any other purpose than to verify fair instruction to all groups. The tapes will NOT be transcribed, nor will they be accessible to anyone except myself.
10. At the end of the week, students will be asked to write about what they learned and will answer a reading questionnaire.

This study will be fun and exciting for your child! If he/she chooses to participate and agrees to keep these rules during the week, please have him/her sign their name on the permission form and return it to school TOMORROW.

I appreciate your cooperation.

Sincerely,

Emily Anderson
University of Maryland, College Park

Principal’s Signature of Approval
APPENDIX B
Teacher Questions for the Week

The following questions were used for all four groups to keep students focused on the task.

Monday’s Questions:
1. What is a turtle?
2. What is a crab?
3. How are crabs and turtles similar?

Tuesday’s Questions:
1. How are crabs and turtles different from each other?
2. What are crabs’ and turtles’ important characteristics?
3. Why are they like that?

Wednesday’s Questions:
1. How do crabs and turtles move?
2. Where and how do turtles live?
3. Where and how do crabs live?

Thursday’s Questions:
1. How do crabs and turtles grow?
2. How do turtles survive?
3. How do crabs survive?
APPENDIX C

Daily Chronicle of Events and Procedures
for the Three Treatment Groups and Control Group

Treatment Groups

Group 1: Science observation + interesting texts treatment group. The first of three treatment conditions was the Observe + Texts treatment group. There were 23 students in the observe + texts group at School 1 and 19 students in the observe + texts group at School 2. On Monday, the first day of treatment, all students in the observe + texts group received a green folder with their individual name and identification number on it. These folders kept the daily writing logs throughout the one-week intervention. Students in this treatment condition were given a 74-page interesting texts booklet.

Students in this group also had access to live turtles and live hermit crabs.

On Monday, I put two posters on the blackboard. One poster had Monday’s questions on it and remained up all day because all of the groups had the same questions. There was a different poster, however, for the activities for the observe + texts treatment group. For Monday, these activities were: observe animals, preview booklet, read, and interest question. I explained to the observe + texts group that they would have time for each activity and I would instruct them when to change from one activity to the next. I also told the students, in advance, how much time they would have to complete each activity. I gave the students further directions about filling out their writing logs and what each page meant. The writing logs for this treatment condition were slightly different than the writing logs for the other groups because I
included a blank piece of paper for drawing in the observe + texts students' writing logs. Together, we went through each page of the log and I answered students' questions about the week's assignments or procedures. Students filled out their logs as I spoke, writing down their names, identification numbers, day of the week, and group color (e.g., green) in the spaces provided. From the first page of the writing log, I read aloud the question they were responsible for answering, as they read along with me. These directions took 3-4 minutes.

Once the students understood the procedures and directions for the week, the first activity was observing and interacting with the animals. I set up stations in the back of the room where the crabs and turtles were placed on tables for observation. Both turtles were contained in their own 10-gallon aquarium tank on separate tables. There were three stations of crabs on two different tables. Each station had a container with three crabs each. There was enough room for 5-6 students to gather around the tanks and containers to see the animals. I provided latex gloves for all of the students to wear for protection against any germs from the animals. Students were allowed to hold the turtles and crabs, provided they had gloves on.

The first activity on Monday was science observation. Students observed the hermit crabs and turtles for 15 minutes. I monitored the tables of animals, making sure the students were handling the animals carefully, and listening to their questions and observations about the animals. Students observed the hermit crabs retracting into their shells, then coming out, walking quickly away, and retracting into their shells again when a student approached them. Many questions and calls for attention to other students arose from these animals. Students' level of interaction with the animals and
with each other was high. Students were squealing, laughing, talking excitedly and loudly as the animals moved or changed. When the observation time was over, the students took off their latex gloves and reluctantly returned to their seats to continue with the next activity.

The next activity on Monday was previewing the 74-page booklet. I introduced the observe + texts group to the interesting texts. I made this booklet, so it was new to the students. The book has a Table of Contents, listing all of the sections with titles and page numbers, and Index. and Glossary in the back of the book. I showed them how to fill out their writing log when they took notes from the booklet. I answered any procedural questions the students had and clarified any confusion. The wrote down their questions or ideas about the crabs and turtles in their writing logs. I read the questions on the poster aloud to the students and told them they could use these questions to guide their search for answers, or they could write their own questions. I asked the students to think about questions that they had, as they searched for knowledge about crabs and turtles. I gave the students 15 minutes to preview and read the 74-page booklet. The final activity for Monday was the Situation Interest question. I spent 1 minute explaining how to answer this question. I told the students to circle their rating of how much they enjoyed today’s activities and then told them they needed to support their rating with reasons. I encouraged the students to write down as many specific reasons as possible. The session ended after a total of 40 minutes.

On Tuesday, I began the session with a reminder of the rules and procedures of the week. There were new posters on the blackboard: one with Tuesday’s questions for all the groups and one with the activities for the observe + texts treatment group. The
activities for Tuesday were: Observe Animals. Student Questions. Teacher Question. and Read. There was a new writing log in each student’s folder. They began writing their names on them as I went over the day’s activities and the questions on the board. I encouraged the students to think about the questions as they observed and interacted with the animals.

The session began with science observation. The students had 15 minutes to observe the animals. They were familiar with the routine, so the students quickly put on their gloves so they could hold the animals. After 15 minutes, students took their gloves off and returned to their seats. I told them that I had overheard many interesting questions asked in their conversations during the observation. I encouraged the students to write down as many of their questions as they could remember in their writing log. I gave them 10 minutes to write questions. I told the students it was optional to write down the questions on the poster. The last 15 minutes were spent reading the booklet and searching for knowledge about crabs and turtles. Although I reminded the students that they were to work on their own, the talking about crabs and turtles at each table never subsided. There was a continuous buzz of talking, finger pointing, and “Hey, look at this!” going on. The session ended reluctantly after a total of 40 minutes.

Wednesday’s session began with two new posters on the blackboard: one with Wednesday’s questions for all the groups, and one with the day’s activities for the observe + texts treatment group. The activities for Wednesday were: Observe Animals. Teacher Questions. Read. and Interest Question. I explained the activities and the time allowed for each activity. I also read the questions aloud and encouraged the students to think about them as they carefully observed the turtles and hermit crabs. There was a
new writing log in the students' folders and they began writing their names on them as I reread the question for the week and reminded them of their assignment.

On Wednesday, the first activity was science observation. The students were only allowed to observe for 5 minutes. I did not allow the students to hold the turtles because there was not enough time for everyone to hold them. I allowed them to pick up the hermit crabs because the crabs did not require latex gloves for safety. After 5 minutes, the students returned to their seats and read their booklets. I gave the students 25 minutes to read and take notes on what they learned. The students answered the situation interest question for the last 10 minutes of the session. The session ended after a total of 40 minutes.

On Thursday, there were two posters on the blackboard like the other days. One poster had Thursday's questions for all the groups. The other poster had the activities of the observe + texts treatment group, which were: Observe Animals. Teacher Questions. Read. Share Knowledge with a Buddy. The students filled out their new writing log as I reminded them of the question they were responsible for answering. I reminded them that this was their last day they had to learn about crabs and turtles, so to use their time wisely. The first activity was science observation. The students were allowed to observe for only 5 minutes so they were only allowed to touch the hermit crabs. The same rules applied from Wednesday. After 5 minutes of observing, the students returned to their seats to read. I gave them 25 minutes to read and take notes. The last activity was sharing their knowledge. Many children chose not to share and continued working. The session ended after a total of 40 minutes.
Group 2: Science observation only. The second treatment condition was the Observe Only treatment group. There were 23 students in the observe only group at School 1 and 19 students in the observe only group at School 2. On Monday, the first day of treatment, all students in the observe only treatment group received a yellow folder with their individual name and an identification number on it. These folders kept the daily observation logs throughout the one-week intervention. Students in this treatment condition were not given any text. Students in this group had live turtles and live hermit crabs. Students gained their information through direct, hands-on observation and interaction with these animals.

On Monday, I put two posters on the blackboard, like I did for the other groups. The poster with Monday’s questions remained up all day, because all of the groups had the same questions. There was a different poster, however, for the activities of the observe only treatment group. For Monday, these activities were: Observe Animals, Teacher Questions, Draw, Interest Question. I explained to the observe only group that they would have time for each activity and I would instruct them when to change from one activity to the net. I also told the students, in advance, how much time they would have to complete each activity. I gave the students further directions about filling out their observation log and what each page meant. Together, we went through each page of the log I answered students’ questions about the week’s assignment or procedures. Students filled out their logs as I spoke, writing down their names, identification numbers, day of the week, and group color (e.g., yellow) in the spaces provided. From the first page of the writing log, I read aloud the question they were responsible for answering, as they read along with me. These directions took 3-4 minutes.
Once the students understood the procedures and directions for the week, the first activity was science observation. Students observed the hermit crabs and turtles for 15-16 minutes. I monitored the tables of animals, making sure the students were handling the animals carefully, and listening to their questions and observations about the animals. Some students had never seen a hermit crab. Students picked them up and watched them walk all over the table. Students observed the hermit crabs retracting into their shells, then coming out, walking quickly away, and retracting into their shells again when a student approached them. This pattern of behavior prompted many questions and calls for attention to other students. When the observation time was over, the students took off their latex gloves and returned to their seats to continue with the next activity. I gave the students 2-3 minutes to copy down the questions from the poster on the blackboard. Then, I gave the students 13-14 minutes to draw and to write in their observation log. I only allowed pencil drawings. Students were not allowed to use crayons, markers, or colored pencils. The final activity for Monday was the Situation Interest question. I spent 1 minute explaining how to answer this question. I told the students to circle their rating of how much they enjoyed today's activities and then told them they needed to support their rating with reasons. I encouraged the students to write down as many specific reasons as possible. The session ended after a total of 40 minutes.

On Tuesday, I began the session with a reminder of the rules and procedures of the week. There were two new posters on the blackboard: one with Tuesday’s questions for all the groups and one with the activities of the observe only treatment group. The activities for Tuesday were: Observe Animals. Student Questions. Teacher
Questions. and Draw. There was a new observation log in each student’s folder. They began writing their names on them as I went over the day’s activities and the questions on the board to think about. I encouraged the students to think about the questions as they observed and interacted with the animals. I reminded them of their assignment for the week by rereading the question they were responsible for answering on the first page of their observation log.

Tuesday’s session began with science observation. The students had 15 minutes to observe the animals. They were familiar with the routine, so the students quickly put on their gloves so they could hold the animals. After 15 minutes, students took their gloves off and returned to their seats. I told them that I had overheard many interesting questions asked in their conversations during the observation. I encouraged the students to write down as many of their questions as they could remember in their observation log. I gave them 10 minutes to write questions. Then, I gave them 2-3 minutes to write down the questions on the poster. The last 15 minutes were spent drawing, and answering the questions. These students did not have any text to read. Many students did not write answers, while others wrote answers down from what they had observed. The session ended after a total of 40 minutes.

Wednesday’s session began with two new posters on the blackboard: one with Wednesday’s questions for all the groups, and one with the day’s activities for the observe only treatment group. The activities for Wednesday were: Observe Animals, Teacher Questions, Write Story, and Interest Question. I explained the activities and the time allowed for each activity. I also read the question aloud and encouraged the students to think about them as they carefully observed the turtles and hermit crabs.
There was a new observation log in the student's folders and they wrote their names on them as I reread the question for the week and reminded them of the their assignment. I reminded the students that they should gather as much information as possible to be able to explain the differences between crabs and turtles. I encouraged them to think about these differences and similarities as they observed the animals. I encouraged them to look closely and carefully at each animal and to pay attention to their shapes, movements, and characteristics.

On Wednesday, the first activity was science observation. The students were only allowed to observe for 5 minutes. I did not allow the students to hold the turtles because there was not enough time for everyone to hold them. I allowed them to pick up the hermit crabs because the crabs did not require latex gloves for safety. After 5 minutes, the students returned to their seats and wrote down the questions from the poster. The next activity was designed to help with behavior control. The observe only group needed an activity to keep them focused because they did not have any text to read. I asked the students to write a story about a crab, a turtle, or both. I explained that although the story would be fictional, one of the requirements was to include factual information about crabs and turtles in the story. I reminded the students that by spending three days observing and touching real turtles and hermit crabs, they had learned real things about them, such as, their color, how they act, how they move, and many other characteristics about them. I gave the students 25 minutes to write. The students answered the situation interest question for the last 10 minutes of the session. The session ended after a total of 40 minutes.
On Thursday, there were two posters on the blackboard like the other days. One poster had Thursday’s question for all the groups. The other poster had the activities for the **observe only** group which were: Observe Animals. Teacher Questions. Finish Story. Share Story with a Buddy. The students wrote on their new observation log as I reminded them of the question they were responsible for answering. I encouraged them to think of the daily questions and to try to incorporate as many of the answers to these questions into their study. I reminded them that this was the last day they had to learn about crabs and turtles, and to use their time wisely.

Thursday’s first activity was science observation. The students were allowed to observe for only 5 minutes so they were only allowed to touch the hermit crabs. The same rules applied from Wednesday. After 5 minutes of observing, the students returned to their seats to finish their story. I gave them 25 minutes to finish. The last activity was sharing their stories. Most of the students wanted to read their story to the entire group, but in the interest of time, they read their stories to the people at their table. The session ended after a total of 40 minutes.

**Group 3: Interesting texts only.** The last of three treatment conditions was the **Text Only** treatment condition. There were 23 students in the **texts only** group at School 1 and 18 students in the **texts only** group at School 2. Students in this treatment condition were given the same 74-page interesting texts booklet as the **observe + texts** group had.

On Monday, I put two posters on the blackboard, like I did for the other groups. One poster had Monday’s questions on it, which was the same for all groups. The second poster listed the activities for the **texts only** treatment group, which were:
Preview Booklet. Teacher Questions. Read. and Interest Question. I explained to the text only group that they would have time for each activity and I would instruct them when to change from one activity to the next. The students were told in advance how much time they would have to complete each activity. I gave the students further directions about filling out their writing logs and what each page meant. Together, we went through each page of the log and I answered students’ questions about the week’s assignment or procedures. Students filled out their logs as I spoke, writing down their names, identification numbers, day of the week, and group color (e.g., red) in the spaces provided. I read aloud the question they were responsible for answering from the front page, as they read along with me. Then, I introduced the students to the booklet. I showed them that the book had a Table of Contents, listing all of the sections with a title and a page number and I showed them the Index and Glossary in the back of the book. Next, I showed them how to fill out their writing log when they took notes from the booklet. Any questions the students had, I clarified. These directions took about 4-5 minutes.

The session proceeded by having the students preview the booklet for 8-10 minutes to become familiar with the kinds of information that would be available to them. The students were unable to do this quietly. As I monitored the room, I heard conversations about crabs and turtles, watched students point to pictures in the book and encourage their friends to find the same page. After previewing the booklet, the students had 2-3 minutes to write down the questions on the poster that I had previously explained. Once the questions were written in the students’ logs, the students were given 14-15 minutes to read the booklet, in any way they chose, and then answered the
questions. The students in the Texts Only group were encouraged to do their own work and not to discuss what they found with their friends. The final activity for Monday was answering the Situation Interest question. I explained how to do this and prompted students to think of as many reasons as possible to support their rating of the day’s activities. The students were allowed about 8-10 minutes to answer this question. The session ended after a total of 40 minutes.

Tuesday’s session began with the same procedures as Monday. A new activity poster was on the blackboard, including the following activities for Tuesday: Student Questions, Teacher Questions, and Read. All of the students had a new writing log in their folder. The students, familiar with the routine quickly wrote their name and other information in the logs. I reread the main question on the first page of the writing log to remind the students of their task, and encouraged them to find as much information as possible to help them answer this question. Next, I went over the activity poster, making sure students understood what was expected of them. I answered any student questions for clarification. Then, I read aloud the questions for the day.

Following a brief explanation of daily instructions, I asked the students to write down as many questions as possible in their writing log. I told them they had 10 minutes think of questions. The instructions were the same as the control group’s. There were no boundaries on the questions. I told the students they could write down questions they had about what they read on Monday, or anything they wondered about. I reminded the students that they were trying to explain how turtles live and grow, and encouraged them to keep this in mind. After the students wrote their own questions, I gave them 2-3 minutes to write down the questions on the poster. Then, I gave the
students 25 minutes to read to answer the questions they had written in their logs. The session ended after a total of 40 minutes.

On Wednesday, the students had a new writing log in their folder. There were new posters on the blackboard. The activities for Wednesday included: Teacher Questions, Read, and Interest Question. I explained each activity and reviewed the main question the students were trying to answer. Next, I read the new questions aloud and encouraged the students to search for as much information as they could to find complete answers to these questions. Again, I reminded the students of their assignments for the week, and I read aloud the question they were responsible for answering. The students quickly filled out their new writing log and began working.

On Wednesday, the students were given 2-3 minutes to write down the questions on the poster. Students then had 25 minutes to read and search for answers to the questions. I reminded the students to do their own work: but it was difficult to completely stifle their conversations about what they were reading. As I monitored the room, the conversations were about crabs and turtles: some students showed their friends pictures or told them new information they had just read and where to read it. Students were given 10 minutes to answer the Situation Interest question for the day. The situation interest question was exactly the same as Monday’s, so the students understood what to do. I answered any questions that arose during the session. The session ended after a total of 40 minutes.

Thursday’s session began in the same way as the other days. There were two posters on the blackboard: one with Thursday’s activities listed for the texts only group. and one with Thursday’s questions for all groups. The activities were: Teacher
Questions. Read, and Share Knowledge with a Buddy. I reminded them that this was the last day they had to learn about crabs and turtles, and to use their time wisely. The students were given 2-3 minutes to write down the questions from the poster. Then, I gave them 25 minutes to read the textbook. Some students asked if they could keep the booklets. Some students wanted to know how they could get all the books I used to make the booklet. The final activity was sharing time with a buddy. I gave the students the remaining 10 minutes to share their knowledge about crabs and turtles with their buddy or people at their table.

**Group 4: Control group.** The control group was used as a basis for comparison of traditional or regular classroom instruction to the three treatment conditions. There were 24 students in the control group at School 1 and 20 students in the control group at School 2. Each session lasted for 40 minutes and was videotaped. Students in the Control group used their regular classroom science textbook as a resource during the week. This textbook was the only reading material the students used.

On Monday, the first day of the treatment, my instruction began by explaining the assignment for the week, the materials, and procedures for the week. There were two posters on the blackboard, just like the other groups. Monday’s activities for the control group included: Preview Textbook, Teacher Questions, Read, and Interest Questions. The second poster had Monday’s questions for all groups on it. I explained to the control group that they would have time for each activity and I would instruct them when to change from one activity to the next. Also, I told the students in advance, how much time they would have to complete each activity. The students were given further directions about filling out their writing logs and what each page meant.
Together, we went through each page of the log and I answered students' questions about the week's assignment or procedures. Students filled out their logs as I spoke, writing down their names, identification numbers, day of the week, and group color (e.g., blue) in the spaces provided. These directions took 3-4 minutes.

Monday's session began by having the students preview their textbook for 10 minutes to become familiar with the kinds of information that would be available to them. After previewing the textbook, the students had about 2-3 minutes to write down the questions on the poster that I had previously explained. Once the questions were written in the students' logs, the students were given 15 minutes to read the textbook and answer the questions. I encouraged the students in the control group to do their own work and not to discuss what they found with their friends. The final activity for Monday was answering the Situation Interest question (see Appendix K). I explained how to do this and encouraged students to think of as many reasons as possible to support their rating of the day's activities. The students were allowed about 8-10 minutes to answer this question. The session ended after a total of 40 minutes.

Tuesday's session began with the same procedures as Monday. There were two posters on the blackboard. Tuesday's activities for the control group included: Student Questions, Teacher Questions, and Read. All of the students had a new writing log in their folder. The students were familiar with the routine of writing their name and other information in the logs, so this went quickly. Next, I reread the main question on the front of the writing log to remind the students what their assignment was for the week. I encouraged them for find as much information as possible to help them answer this question. To make certain students understood what was expected of them. I went over
the activity poster, and I answered any student questions for clarification. I also read aloud the questions for the day.

On Tuesday, following a brief explanation of daily instructions, I asked the students to write down as many questions as possible in their writing log. I told them they had 10 minutes think of questions. There were no boundaries on the questions. I told the students they could write down questions they had about what they read on Monday or anything that they wondered about. I reminded the students that they were trying to explain how turtles live and grow. and encouraged them to keep this in mind. After the students wrote their own questions, I gave them 2-3 minutes to write down the questions on the poster. Then, I gave the students 25 minutes to read to answer the questions they had written in their logs. The session ended after a total of 40 minutes.

On Wednesday, students had a new writing log in their folder. There were two new posters on the blackboard. Wednesday's activities for the control group were: Teacher Questions. Read. and Interest Question. I explained each activity and reviewed the main question the students were trying to answer. I read the new questions aloud and encouraged the students to search for as much information as they could to find complete answers to these questions. Again, I reminded the students of their assignment for the week. I read aloud the question they were responsible for answering. The students quickly filled out their new writing log and began working.

On Wednesday, students were given 2-3 minutes to write down the questions on the poster. Students then had 25 minutes to read and search for answers to the questions. Many students complained that the textbook did not have good information, or it had limited information. Students expressed feelings of frustration and boredom.
Next, students were then given 10 minutes to answer the Situation Interest question for the day. The situation interest question was exactly the same as Monday's, so the students understood what to do. I answered any questions that arose during the session. The session ended after a total of 40 minutes.

Thursday's session began in the same way as the other days. The activities were listed on a poster and included: Teacher Questions, Read, and Share Knowledge with a Buddy. I explained the day's activities and went over the questions. I reminded them that this was the last day they had to learn about crabs and turtles and to use their time wisely. The students were given 2-3 minutes to write down the questions from the poster. Then, I gave them 25 minutes to read the textbook. Some students asked if they could have another book to read for information. Many students complained that the textbook did not have information about crabs, only lobsters. The students were talkative: as I monitored the small groups in the room, their conversations were not focused on the task. I encouraged them to find as much information as they could. I encouraged them to do their best. The final activity was sharing time with a buddy. I gave the students the remaining 10 minutes to share their knowledge about crabs and turtles with their buddy or people at their table. The session ended after a total 40 minutes.
APPENDIX D

Writing Log

Group: ______________________________

Day: __________________ Name: ________________________ ID# ______

WRITING LOG:

Instructions: This log is for you to write down the information that you learn this week about crabs and turtles. You will write in the logs every day. You may use as many pages as you need. Some of the information available to you during the week will be helpful, and some will not. Remember to choose information that will be the most helpful to you in answering the question below.

The question you are trying to answer is: EXPLAIN HOW CRABS AND TURTLES LIVE AND GROW. How are they similar? How are they different from each other? In thinking and writing about this answer, you may want to think about the following questions to help you. What is a crab? What is a turtle? What are their important characteristics? How do they live together and survive in the same habitat? Answer each part of the log every day. Write as much as you can.

A. What are you looking at? Describe what you see.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
B. What questions do you have?
C. What are you learning?
APPENDIX E

Observation Log

Group: ____________________________

Day: __________ Name: ____________________________ ID# ___

OBSERVATION LOG:

Instructions: This log is for you to write down the information that you learn this week about crabs and turtles. You will write in the logs every day. You may use as many pages as you need. Some of the information available to you during the week will be helpful, and some will not. Remember to choose information that will be the most helpful to you in answering the question below.

The question you are trying to answer is: EXPLAIN HOW CRABS AND TURTLES LIVE AND GROW. How are they similar? How are they different from each other? In thinking and writing about this answer, you may want to think about the following questions to help you. What is a crab? What is a turtle? What are their important characteristics? How do they live together and survive in the same habitat? Answer each part of the log every day. Write as much as you can.

A. What are you looking at? Draw and describe what you see.
You may use this page for drawing.
B. What questions do you have?
C. What are you learning? What is changing or happening?
APPENDIX F

Prior Knowledge Assessment

Name: __________________________ ID#: _______ Group: __________

**ASSESSMENT:** Prior Knowledge

In the space below, EXPLAIN HOW CRABS AND TURTLES LIVE AND GROW. In writing your answer, you may want to think about the following questions to help you. How are they similar? How are they different from each other? How do they live together and survive in the same habitat?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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APPENDIX G

Situational Interest

Please circle the answer that describes how much you enjoyed what you did today.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>It was kind of boring</td>
<td>I enjoyed it most of the time</td>
<td>I want to do this all year!</td>
</tr>
</tbody>
</table>

Please list the reasons why you DID or DID NOT like this activity. List as many reasons as you can.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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APPENDIX H

Conceptual Knowledge Assessment

Name: ___________________________ ID#: _______ Group: ____________

ASSESSMENT: Conceptual Knowledge

You have learned a lot of information about crabs and turtles this week. Suppose you were chosen to explain about crabs and turtles to 4th graders. You would need to explain how crabs and turtles live and grow. What is a crab? What is a turtle? What are their important characteristics? You would also need to explain how crabs and turtles live together and survive in the same habitat.

A. DRAW A PICTURE TO SHOW HOW CRABS AND TURTLES LIVE AND GROW. Be sure to label all of the important parts of your drawings.
B. Using your drawings and what you can remember about what you have learned this week. WRITE AN EXPLANATION OF HOW CRABS AND TURTLES LIVE AND GROW. How are they similar? How are they different from each other? Be sure to write about their important characteristics. Think about how crabs and turtles live together and survive in the same habitat. Use science ideas in your explanation. Write as much as you can.
APPENDIX I

Reading Motivation Questionnaire

**Intrinsic Composite:**
- Efficacy
- Curiosity
- Involvement
- Challenge

**Extrinsic:**
- Reading
- Work Avoidance

**MOTIVATION QUESTIONS:**

**Intrinsic:**

A. **Efficacy.**
  9. I am a good reader.*
  10. Sometimes I don't feel as smart as others in reading.*
  3. I know I will do well in reading this year.*
  26. I can find information about living animals by reading.
  18. I learn more from reading about living things than most students in the class.
  12. I don't know why it was hard for me to find information about crabs and turtles.

B. **Curiosity.**
  15. I have favorite subjects that I like to read about.*
  20. I read about my hobbies to learn more about them.*
  22. I enjoy reading books about people in different countries.*
  21. I like reading about living things.
  4. If the teacher discusses an animal, I might read more about it.
  17. I like to learn about crabs and turtles and find out new facts.

C. **Involvement.**
  13. I read stories about fantasy and make believe.*
  27. I make pictures in my mind when I read.*
  25. I read a lot of adventure stories.*
  23. I thought it was interesting to study crabs and turtles.
  30. I enjoyed finding lots of information about crabs and turtles.
  6. I lost track of time learning about crabs and turtles.
D. Challenge.
28. I like it when the questions in books make me think.*
19. I like to look up words I don't know.*
2. I like hard, challenging books.*
29. I liked finding out how crabs and turtles survive.
8. If something about crabs and turtles was interesting, I didn't care how hard it was to learn.
7. I kept searching for information about crabs and turtles until I found what I was looking for.

Extrinsic:
A. Reading Work Avoidance
1. I don't like to read out loud in class.*
11. I don't like having to write about what I read.*
16. I don't like reading stories that are too short.*
5. I don't like reading about animals when the words are too difficult.
24. I thought learning about crabs and turtles was boring.
14. Complicated information about animals was not fun to learn.

* These items were taken directly from the Wigfield, Guthrie, and McGough (1996) Reading Motivation Questionnaire (RMQ). The remaining items were adapted from the (RMQ) to be specific to this task and the topic of crabs and turtles.
APPENDIX J

Rubric for Coding the Performance Assessment

Prior Knowledge, Drawing, and Writing

This rubric is the same for the prior knowledge, drawing, and writing portions of the performance assessment. The rubric was extended from a Level 6 to a Level 9 for the Writing portion of the performance assessment.

Level 1

At this level the students present: (1) no information; or (2) scientifically inaccurate information; or (3) one appropriately identified feature, structure, or function for each animal; or (4) two features, structures, or functions for only one animal.

Level 2

Students present a combination of 2-4 general or specific features of the animals or structures of functions for at least one of the animals. However, no relationships among them are demonstrated. At this level students may also present scientifically inaccurate information.

Level 3

At this level the student may present accurate and relevant information for a minimum of four specific features, structures, or functions of one animal. An alternative response is that students could present any relationships or connections between the structures, features, and the functions of the animals but the relationships
are implicit through comparison or vague, meaning that they don't explain "why." No explanations for relationship for features or structures are presented.

Level 4

At this level a student presents all of the necessary elements for a level 3 but the relationships or connections between features, structures, or functions of the animals are presented explicitly. Students at this level explain "why." However, these relations are stated only for one animal and the other remains implicit or vague. Students may also present their answer in the form of a clear relationship for one animal that was not transferrable to the other. Explanations were explicitly included and were distinguishable from particular facts or statements about the animal and structural or functional characteristics.

Level 5

At this level students write an explicit relationship between features, structures, and/or functions for both animals. The comparison is often parallel, with one type of structural characteristic of one of the animals comparable to a type of structural characteristic of the other animal, showing symmetry. However, answers at this level lack connections between the relationships between the features, structures, or functions. An alternative means for obtaining a Level 5 is to present a fully explained, systemic (Level 6) response for only one animal with very limited information on the second animal.
Level 6

At this level students clearly and fully explicate the principles that link the features of the animals in terms of "systems." A systemic answer is given for both animals. For example, life cycles or animal characteristics of certain structures and the relationship of these features, structures and functions of their respective species are stated. The systems are governed by principles centered around the characteristics of the species, habitat, survival, growth and life cycles, food chains, adaptations, etc.

Level 7

Students provide a Level 6 answer plus elaborated features for both animals.

Level 8

Students provide a Level 7 answer plus elaborated relationships between features and functions for both animals.

Level 9

Students provide a Level 8 answer plus elaborated systems for both animals.
APPENDIX K

Coding Rubric for Situational Interest

**Level 1:** Student circled 1 or 2 with no reasons. Interest level is LOW. Student expressed dislike of learning goals, disliked task and/or topic. Student gave two or more reasons why he/she didn't like the activity. Student expressed explicit dislike (e.g., I hate reading; I hate writing).

**Level 2:** Student circled 1 or 2. Interest level was LOW. Student did not express learning goals as reasons. Student mostly disliked activity but may have liked one aspect of the task or topic (e.g., I like turtles; I hated writing; I thought it was boring). The things students liked were extrinsic (e.g., we don't get graded).

**Level 3:** Student circled 2 or circled 3 with no reasons. Interest level was MEDIUM. Student gave one or more reasons for enjoying the activity. These reasons were mainly social (e.g., I liked being with my friends), or extrinsic (e.g., I like not getting graded).

**Level 4:** Student circled 2 or 3. Interest level is MEDIUM. Student gave reasons that may be centered around task and/or topic or learning, but only gave 1 or 2 reasons. Student interest is explicitly medium.

**Level 5:** Student circled 3. Interest level is HIGH. Student's reasons focused on task interest. There were still no learning goals described at this point. Student's reasons were focused on the task. Two or more reasons were given. Students at this level loved the task, but did not link the activity to learning (e.g., I loved holding the animals; I loved the pictures in the book).

**Level 6:** Student circled 3. Interest level is HIGH. At this level, student's reasons were explicit about learning goals (e.g., I love learning; I love reading; I loved learning new things about turtles). Two or more reasons were given that focused both on learning goals and task and topic interest. These students liked observing and reading AND they liked crabs and turtles.
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