

## ABSTRACT

Title of dissertation: THE ASSOCIATIONS OF AUTONOMY SUPPORT AND CONCEPTUAL PRESS WITH ENGAGED READING AND CONCEPTUAL LEARNING FROM TEXT

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This study examined the associations of autonomy support and conceptual press, with reading engagement and conceptual learning from text. When students perceive their teacher to be supporting autonomy, it means that student choice, ownership, and personal goals are emphasized. When students perceive their teacher to be supporting conceptual press, it means that the teacher (a) promotes understanding of the substantial principles of a domain; (b) helps students use information integration strategies during reading, such as concept mapping, and (c) promotes persistence on moderately challenging tasks. Based on the self-process model of motivation (Connell & Wellborn, 1990) and an engagement perspective of reading (Baker, Dreher & Guthrie, 2000), it was hypothesized that as students perceived their instruction to be motivating, their reading engagement would increase. In turn, as engaged reading increases, conceptual learning from text would increase. For this investigation, 244 fourth- and fifth-grade students reported their perceptions of their teachers' use of conceptual press and autonomy support in reading instruction. Multifaceted components of reading engagement were measured. Reading engagement was defined as the manifestations of affective, behavioral, and cognitive

processes during reading. In addition, participants completed a reading performance assessment in the domain of science designed to measure prior knowledge, strategic reading, and conceptual learning from text. Structural equation modeling was used to compare alternative theoretical models depicting the relations among motivated reading instruction, engaged reading, and conceptual learning from text. The direct effects model had a direct path connecting motivating reading instruction with conceptual learning from text whereas the hypothesized indirect effects model contained an indirect path from motivating reading instruction to conceptual learning from text via engaged reading. Results confirmed the hypothesis that the model including an indirect effect of motivating reading instruction on conceptual learning from text through engaged reading explained the data more fully than a direct effect model. This is consistent with the self-process model of motivation (Connell & Wellborn, 1990). These results have implications for theories of the role of social contexts in engagement and achievement, particularly in the domain of reading, and also suggest ways by which teachers might foster reading engagement among students.

THE ASSOCIATIONS OF AUTONOMY SUPPORT AND CONCEPTUAL PRESS  
WITH ENGAGED READING AND CONCEPTUAL LEARNING FROM TEXT

by

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DEDICATION

To Mom and Dad

For making this possible

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Since childhood, I have been drawn to books. For me, the beauty of reading is that in each work, there is always a lesson to be learned. From reading Betty Smith and Maya Angelou to William James and James Dewey, I have learned about joy, teaching, and the resiliency of the human spirit. Finally, my personal love of reading and my professional desire to inspire children to read have merged to forge one path.

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## Chapter I

### INTRODUCTION

Conceptual learning is a primary goal of education (Alexander, 1996; Brown, Bransford, Ferrara, & Campione, 1983; Perkins & Unger, 1999; Seidel, Perencevich, & Kett, in press; Wiske, 1998). Nevertheless, our failure to help students gain conceptual knowledge has been widely documented (National Assessment of Educational Progress, 1996; Snow, Burns, & Griffin, 1998). There is a call for teachers to help students understand the explanatory principles that underlie a domain of knowledge (Alexander, 1998a; Bereiter & Scardamalia, 1989; Chi, DeLeeuw, Chiu, & Lavancher, 1994) rather than merely pass a factual test on a text topic (Lambert & McCombs, 1998; Resnick, 1987). To that end, current curricular reform movements promote an instructional shift from simple fact accumulation to conceptual understanding (Brown, 1997; Guthrie, Wigfield, & Perencevich, 2004a; Perkins & Unger, 1999; Sternberg, Torff, & Grigorenko, 1998). Alexander (1998a) noted that "if students are to acquire a principled body of knowledge that is the hallmark of competent and proficient learning in a domain, then it is logical that the educators should teach toward principled understanding" (p. 73).

These goals are particularly important for elementary-aged students in light of the current research that connects reading with growth in conceptual learning (Cunningham & Stanovich, 1997). Stanovich (2000) stressed that "print is a uniquely rich source of content" (p. 306). Further he argued that "only print provides opportunities for acquiring broad and deep knowledge of the world" (p. 307). Since reading is one of the primary channels through which individuals gain knowledge, it is the foundation of this dissertation study.

It is well documented that students find it difficult to gain conceptual knowledge from expository text (Spires & Donley, 1998; Stanovich & Cunningham, 1993). For example, the phrase "fourth-grade slump" describes the struggle that students encounter when reading to learn in the content areas (Alexander, 1997a; Dreher, 2000). Equally sobering is that as elementary children progress through school, their intrinsic motivation for reading declines significantly (Wigfield, Eccles et al., 1997). This dissertation study focuses on motivating practices in the upper elementary grades that may help students maintain or even heighten their reading motivation and engagement. It is hypothesized that when children perceive conceptual press and autonomy support to be occurring in their classrooms, then reading engagement will increase. In turn, as reading engagement increases, conceptual learning from reading expository text will increase.

### *The Engagement Perspective of Reading*

Recent research developments, particularly in reading, have recognized the importance of engagement (Alexander & Fox, 2004; Guthrie & Wigfield, 2000) as a potential link to conceptual learning. In fact, in the most recent edition of *Theoretical Models and Processes of Reading*, Alexander and her colleague (2004) rightly recognized that we have entered into the *Era of Engaged Learning*. However, the concept of engagement is relatively new and researchers are now exploring best ways to define and measure this multifaceted construct (Fredericks, Blumenfeld, & Paris, 2004). In the domain of reading, engagement has referred to the shared functioning of motivation, conceptual knowledge, and cognitive strategy use during reading (Guthrie & Wigfield, 2000).

During reading engagement, motivational and cognitive processes are focused on gaining conceptual understanding in a sustained and cognitively effortful manner. Engaged readers establish personal intentions for reading, use cognitive strategies to intentionally seek knowledge, manipulate information gathered from their reading, and explore multiple texts to extend their conceptual knowledge. It is my contention that the outcome of conceptual learning from text in science depends on (a) affective engagement processes, such as intrinsic motivation for reading; (b) cognitive engagement processes, such as reading strategy use; and (c) behavioral engagement processes, such as wide and frequent reading in a domain. These affective, cognitive, and behavioral properties of the self come to coordinated action and manifest themselves as reading engagement. I describe these affective, behavioral, and cognitive attributes of engaged reading throughout this review.

Several studies have established the academic benefits of engaged reading on conceptual learning from text (Cipielewski & Stanovich, 1992; Guthrie, Anderson, Alao, & Rinehart, 1999). For example, in a path analysis, Guthrie and his colleagues (1998) showed that reading engagement had a significant influence on third and fifth graders' ability to gain conceptual knowledge from text. Specifically, motivated strategy use had a direct significant influence on conceptual learning from expository text with an effect size of .76 for third graders and 1.08 for fifth graders. Gottfried (1990) also found significant correlations between motivation and reading comprehension for elementary school children in a longitudinal investigation. Students' self-reported intrinsic motivation at age seven was significantly correlated with reading comprehension at age nine. This finding gives credence to the potential causal relations between reading engagement and

reading outcomes. Since reading engagement contributes to conceptual learning from text, it is important to establish how teachers might enhance engaged reading among elementary school children.

### *Motivating Reading Instruction Fosters Engaged Reading*

Several instructional programs (e.g., Au, 1997; Brown, 1997; Guthrie & Cox, 1998; Miller & Meece, 1997; Scardamalia, Bereiter, & Lamon, 1994) have characterized motivating contexts that foster engaged reading. For example, to promote engaged reading, Guthrie (1996) designed an instructional approach called Concept-Oriented Reading Instruction (CORI). CORI teachers were trained to use several guiding strategies of instruction including: conceptual themes that utilize central disciplinary principles of a domain, real-world observation, autonomy support, collaboration support, cognitive strategy instruction, and self-expression.

In several quantitative studies of CORI, the benefits of motivating instruction on conceptual learning from text, reading strategy use, and subsequent reading motivation have been documented (Guthrie et al., 1996; Guthrie, Anderson et al., 1999; Guthrie, Van Meter, Hancock, Alao, Anderson, & McCann, 1998; Guthrie, Wigfield, Barbosa et al., 2004; Guthrie, Wigfield, & VonSecker, 2000). Other classroom intervention programs, such as Brown's (1997) Fostering Communities of Learners (FCL) program and Scardamalia and her colleagues' (1994) Computer-Supported Intentional Learning Environments (CSILE) program, have reported similar results in student engagement and conceptual learning.

Converging qualities of motivating instruction were apparent in these programs. Specifically, each of the programs provided conceptual press and autonomy support

during learning. For example, to support engagement in these programs, students were encouraged to construct different representations of their knowledge (i.e., artifacts and concept maps) and they were guided to acquire principled bodies of knowledge. Also, teachers gave students some latitude to choose and pursue academically and personally relevant goals. Each of the programs offered moderately challenging tasks and had supports in place for students to take on the challenge. Each of the programs afforded opportunities for students to exercise autonomy and reshape tasks to align with self-conceived goals. Finally, these programs allowed students to use cognitive and metacognitive skills to pursue conceptual outcomes.

All of these examples of motivating instruction may be important in increasing students' engagement. Indeed, in an ethnographic study, Pressley and his colleagues (1996) confirmed that outstanding reading teachers provided academically rich and connected activities, fostered choice, taught reading strategies, and offered a variety of challenging texts in order to promote engagement in reading. In fact, Baker, Dreher, and Guthrie (2000) argued that "because engaged reading includes equal parts competence and motivation, teachers should allocate attention evenly to each of these twin goals" (p. 11). This dissertation study focuses on instructional practices that support cognitive, behavioral, and affective components of engagement.

### *Self-Determination Theory*

Theoretically, researchers also advocate the use of motivational and cognitive supports to encourage engagement. According to self-determination theory, humans have three innate psychological needs that are the basis of their self-motivation processes. The three needs are competence (Harter, 1981; White, 1959), autonomy (deCharms, 1968;

Deci & Ryan, 1987), and relatedness (Furrer & Skinner, 2003; Ryan & Stiller, 1991; Wentzel, 2002). According to Deci and Ryan (1987), social contextual conditions either facilitate or forestall the satisfaction of these needs. Indeed, the evidence clearly indicates that certain qualities of the classroom context can and do promote engagement (Fredericks, Blumenfeld, & Paris, 2004) and particularly engagement in reading (Guthrie & Humenick, 2004; Guthrie, Wigfield, Barbosa et al., 2004; Pressley, Rankin, & Yokoi, 1996). However, few studies have attempted to isolate and examine the motivational elements of these contexts to examine their relations with engaged reading and conceptual learning from text. For example, in the aforementioned studies, multiple motivational principles seemed to be operating to promote engagement. This study attempts to assess students' perceptions of their teacher's specific motivational practices. It is proposed that these perceptions will be associated with reading engagement. Thus, two aspects of motivating reading instruction will be examined. In this study, students' perceptions of their teachers' use of conceptual press and autonomy support will be examined.

### *Two Aspects of Motivating Reading Instruction*

*Conceptual press.* In this study, I propose that one way to engage readers is through offering and supporting conceptual press (see Cox & Guthrie, 2002). Conceptual press in the reading classroom refers to students' perception of instruction that (a) promotes understanding of the substantial principles of a domain, such as life science (Alexander, 1998b; Chi et al., 1994); (b) helps students use information integration strategies during reading, such as concept mapping, and (c) promotes the principle of

moderate challenge during reading tasks (Csikszentmihalyi, 1997; Turner, Parkes, Cox & Meyer, 1995; Turner et al., 1998).

First, teachers who emphasize conceptual press help students move flexibly between the facts and generalizations of a domain. For example, it is important for students to distinguish among various features of an animal (e.g., fur or claws); however it is equally critical for them to understand how these features relate to survival concepts such as locomotion or defense, and how these systems of relations explain principles of ecology. A focus on how facts and concepts relate to each other may benefit cognitive engagement because students may become more facile at (a) generating connections among ideas; (b) recognizing and reconciling discrepant incoming information; and (c) organizing information. Further, understanding how the facts and substantial principles of a domain relate may be affectively and cognitively engaging because one is pursuing depth rather than trivia and expertise rather than superficial knowledge.

A second characteristic of conceptual press involves giving students' opportunities to reorganize incoming information into different forms during or after reading. When students create new representations of incoming information, such as concept mapping (Novak, 1998), constructing projects or building models (Brown, 1997), or drawing graphical representations (Chi et al., 1994; Van Meter, 2001), they may experience engagement because of the cognitive depth these activities require and because of the affective enjoyment they may elicit. Activities that may prompt students to reorganize information during or after reading may include (a) explaining information to oneself or others; (b) summarizing information; and (c) drawing diagrams, illustrations,

concept maps, charts or tables to extend one's knowledge. These types of activities may support cognitive, affective and behavioral engagement.

Third, conceptual press in reading includes offering students' opportunities to experience moderate challenge and support them to take on the challenge (Csikszentmihalyi, 1990; Middleton & Midgley, 2002; Turner & Meyer, 2004). Moderate challenge is defined as the alignment of reading tasks and text sources slightly above one's current skill level. There is evidence that when challenges are slightly ahead of skills, a tension is created that stimulates concentration and effort (Csikszentmihalyi, Rathunde & Whalen, 1993). Moderately challenging activities increase cognitive and affective engagement because students learn to be devoted to deep thinking and concerted attention.

According to Csikszentmihalyi and his colleagues (1993), when students seek to meet increasingly difficult goals, they experience concrete evidence of their growth. This evidence, in turn, increases their perceptions of competence (Schunk & Pajares, 2002) and willingness to persist in the face of difficulty (Bandura, 1982; 1997). Second, moderately challenging texts and tasks allow students the opportunity to learn from their mistakes (Clifford, 1991). When students learn not to be discouraged by the first hurdle they encounter, they will begin to take on risks, set higher goals, develop sophisticated strategies, and persist longer in learning activities (Clifford, 1988). In short, moderate challenge as an instructional strategy may be an important contributor to students' engagement in reading. In sum, I have conceptualized three aspects of conceptual press. My hypothesis is that conceptual press will be positively associated with engaged reading, which in turn, will enhance conceptual learning from text.

*Autonomy support.* Another approach to increasing reading engagement is supporting students' autonomy during learning. Autonomy during learning is supported when teachers allow children latitude in their learning activities and give them opportunities to make their learning personally relevant through the construction of self-generated goals. Therefore, autonomy support refers to student perception of control over the goals, content, strategies, standards for success, and social interaction patterns in their learning environment. Central instructional components of autonomy support involve (a) giving significant academic choices to students (Deci & Ryan, 1987); (b) allowing students to create learning goals that align with their prior knowledge and individual interests; and (c) fostering an ownership of ideas (Brown, 1997; Stefanou, Perencevich, DiCintio, & Turner, 2004).

A positive and significant relation between autonomy support and affective engagement in learning has been supported across numerous studies (e.g., Grolnick & Ryan, 1987; Ryan & Stiller, 1991; Turner, 1995). In general, these studies indicate that when students are given an opportunity to shape academic goals to represent what they value, they become more engaged with the content (Turner et al., 1998). Also, autonomy support has been shown increase cognitive engagement. Benware and Deci (1984) found that students who learned text material for a personal use reported greater conceptual understanding than students who learned the material in order to take a recall test. An example of autonomy support in reading would involve allowing students to move away from sole reliance on the teacher to interpret texts and move toward crafting their own interpretations about topic or book. In sum, I have conceptualized three aspects of autonomy support. My hypothesis is that when students perceive autonomy support to be

occurring in their instruction, there will be a significant association with engaged reading, which in turn, will enhance conceptual learning from text.

*Motivating Reading Instruction: Creating a Context for Engagement*

Ryan and Deci (2000) stated "for a high level of intrinsic motivation, people must experience satisfaction of the needs both for competence and autonomy" (p. 58). For example, when students are deeply immersed in understanding concepts, they naturally desire to choose topics that are interesting or compelling to them. When students create personal intentions to become experts in a topic, they may choose to read multiple books or use cognitive strategies to fulfill their desires for knowledge growth. During different phases of conceptually pressing activities, students may need freedom to pursue their ideas either through reading texts or organizing their thoughts, or they may need latitude to ask questions of their peers and share their expertise with others. Conversely, when students' perceive conceptual press to be absent, choices, too, become superficial (see Stefanou et al., 2004 for a review of task versus cognitive autonomy support). Thus, tasks requiring lower level thinking are typically prescribed and constraint-laden. In this dissertation, I propose that when the context supports a mutual press for conceptual understanding and support for autonomy and when students' perceive the context to be supportive in these ways, reading engagement will increase. To review, this study specifies two aspects characterizing motivating reading instruction—students' perceptions of conceptual press and autonomy support in reading. In this investigation, I study the relation between motivating reading instruction characterized by these two constructs and engaged reading.

### *Theoretical Framework: Self-Process Model of Motivation*

Connell and Wellborn (1990) proposed a theoretical framework that includes three self-system processes thought to be important to learning. They are relatedness, competence, and autonomy. According to the theory, students develop their perceptions of competence, autonomy, and relatedness on the basis of their interactions in a social context, such as school. When these processes are fostered in the classroom context, engagement is likely to be manifested in affect, cognition, and behavior. Finally, Connell and Wellborn's model suggested that affective, cognitive and behavioral engagement in school influences academic outcomes, such as grades or skills. Aspects of this model have been tested empirically. For example Skinner and her colleagues (1990) found that teacher characteristics of contingency and involvement increased students' perceived control. Perceived control was significantly associated with student engagement which, in turn, had positive benefits on achievement.

Many other researchers have also conceptualized an indirect relation between classroom contexts, students' self-processes, and academic outcomes (see Pintrich & Schrauben, 1992; Schiefele & Rheinberg, 1997 for theoretical reviews, and Connell & Wellborn, 1991; Skinner et al., 1990 for empirical studies using this model). This dissertation study will empirically test the utility of the self-process model of motivation in the domain of reading. Thus, it is hypothesized that students' perceptions of their teachers' motivating reading instruction will be significantly associated with students' engaged reading, such that as motivating reading instruction increases, engaged reading will increase. In turn, as engaged reading increases, conceptual learning from text will increase.

### *Significance of this Study*

This dissertation study extends theoretical knowledge in several ways. First, researchers studying self-determination (e.g., Deci & Ryan, 1987) have long considered both competence and autonomy to be important contributors of student engagement processes. Deci and Ryan (1994) reminded us that "feelings of competence must be accompanied by perceived autonomy in order for one to be intrinsically motivated" (p. 9). However, they also stated that "the majority of the research on the effects of environmental events on intrinsic motivation has focused on the issue of autonomy versus control rather than that of competence" (Ryan & Deci, 2000, p.59). In this study, I suggest that when students perceive the dual accompaniment of conceptual press and autonomy support in reading instruction, there will be evidence of engaged reading which, in turn, will increase conceptual learning from text.

One purpose of this study is to establish comprehensive definitions of conceptual press and autonomy support and measure students' perceptions of their teachers' scaffolding for these motivating practices. It has not been well established in the literature which specific instructional strategies teachers could use to heighten student perceptions of autonomy and conceptual press. For example, while some researchers stress the importance of meaningful and informed choice for students in instruction (Stefanou et al., 2004), others rely on simplistic, insignificant choices in their research and not surprisingly show no effects on engagement (Flowerday, Schraw, & Stevens, 2004). It is important to not only consider choice as an instructional strategy, but to explore what qualities of choice are important in increasing students' engagement. The same recommendations are germane for other aspects of autonomy support and conceptual

press. I have developed a student perception questionnaire specifically designed to describe these domain-specific motivational practices in reading instruction.

Many qualitative studies of reading engagement and reading comprehension have recommended important practices for teachers to utilize in their classrooms (Dolezal et al., 2003; Hacker & Tenent, 2002; Many, 1996). For example, in a qualitative study of reading classrooms, Dolezal and her colleagues identified some one hundred practices that support motivation in reading, including (a) high expectations, (b) appropriate pacing, (c) adult volunteering, (d) connecting reading and writing across the curriculum, (e) teacher encouragement, among others. However, these studies did not discriminate between significant and insignificant practices and there was no criterion for choosing best practices. There is evidence that successful quantitative intervention programs have utilized some of these practices (e.g., Au, 1997; Scardamalia et al., 1994; Brown, 1997; Guthrie, Van Meter et al., 1998). Nevertheless, researchers have not yet specifically measured the extent to which students' perceived these practices to be occurring; nor have they isolated these practices in their research. One purpose of this study is to expand on those qualitative and quantitative findings by empirically testing a smaller set of practices to determine their relations with reading engagement and comprehension outcomes.

Many investigations study motivation as a characteristic of a specific task as opposed to a stable or enduring process (Cordova & Lepper, 1996; Reeve et al., 2003; Reynolds & Symons, 2001). For example, Cordova and Lepper conducted an experiment in which they gave experimental students various activity-related choices while playing a computer game. They measured students' enjoyment, perceived competence, and task

involvement and found these characteristics to be significantly higher among students in the motivationally embellished conditions. While it is important to study student motivation and engagement from a situationally-sensitive perspective, this dissertation study extends the findings of those studies by expanding the definition and measurement of motivation and engagement. Rather than studying engagement from a situationally sensitive stance which is bounded to a particular task, this study attempts to characterize and measure a more generalized representation of reading engagement.

Lastly, this study extends the role of self-process model in motivation research (see Connell & Wellborn, 1991; Guay & Vallerand, 1997; Skinner, 1991; Skinner & Belmont, 1993; Skinner et al., 1990). While this hypothesis has been empirically tested in very specific instances, such as using teacher contingency to define the social context (e.g., Skinner et al., 1990), we are in need of more studies that test other instructional and self-process constructs in order to ensure that the psychological model is generalizable across domains. This study addresses this issue in the domain of reading.

### *Research Hypotheses and Conceptual Definitions*

The purpose of this study is to explore the associations among conceptual press, autonomy support, engaged reading, and conceptual learning from text. First, it is hypothesized that engaged reading will be positively associated with conceptual learning from text, such that as engaged reading increases, conceptual learning from text will increase. Second, it is hypothesized that students' perceptions of their teachers' motivating reading instruction, consisting of conceptual press and autonomy support, will be positively associated with engaged reading, such that as motivating reading instruction increases, engaged reading will increase. Third, it is hypothesized that when comparing

alternative theoretical models, a theoretical model including reading engagement will better explain the relation between motivating reading instruction and conceptual learning from text than a model directly linking motivating reading instruction with conceptual learning from text. This hypothesis is consistent with the self-process model of motivation. Table 1 presents the conceptual definitions being used in this study.

Table 1

*Definitions of Terms*

Main Constructs	Sub-constructs	Definition
Conceptual Learning from Text		The process of constructing new knowledge through interacting with text.
Prior Knowledge		A reader's pre-existing knowledge base, including topical and domain knowledge.
Engaged Reading		The manifestation of affective, behavioral, and cognitive processes during reading.
	Affective engagement	Motivation for reading, including, curiosity, involvement, and preference for challenge during reading.
	Behavioral engagement	Wide and frequent reading in the domain of science.
	Cognitive engagement	Students' deliberate use of approaches to understand text, including searching for information and summarizing information; and reading efficacy.

Table 1 (continued)

*Definitions of Terms*

Main Constructs	Sub-constructs	Definition
Motivating Reading Instruction		Students' perceptions of their teacher's use of conceptual press and autonomy support.
	Conceptual Press	Teacher's support for integrating facts and principles of a domain, reorganizing incoming text information, and persisting during moderately challenging reading tasks.
	Autonomy Support	Teacher's provision of optimal choice, ownership, and personal relevancy in reading.

## Chapter II

### LITERATURE REVIEW

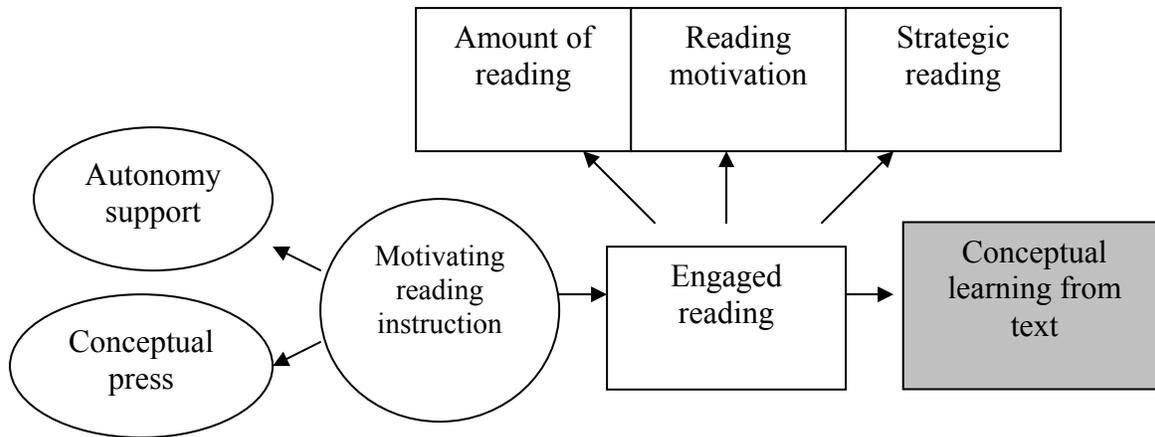
Conceptual learning is a primary goal of education (Alexander, 1997a; Brown, 1997; Linn, Lewis, Tsuchida, & Songer, 2000; Perkins & Unger, 1999; Seidel et al., in press; Sternberg et al., 1998). Nevertheless, our failure to help students gain conceptual knowledge has been widely documented (Alexander & Jetton, 2000; Chall, 2000; Snow et al., 1998). One of the primary channels for students to learn concepts is through reading. However, there is evidence that many fourth- and fifth-grade students struggle to acquire high level conceptual knowledge when reading (Alexander, 1998a; Dreher, 2000).

In this study, I maintain that in order for students to read to gain conceptual knowledge, they must be motivated or engaged readers. Motivation is necessary because conceptual learning from text requires effort, persistence, and a desire to understand. Indeed, James Dewey (1916) wrote about the centrality of students' motivations during learning; "There is on one side, a body of truth ready made, and on the other, a ready-made mind equipped with a faculty of knowing—if it only wills to exercise it, which it is often strangely loath to do" (Dewey, 1916, p. 335). Few would disagree that the most exacting work of a teacher is to create fertile contexts that motivate learners to gain and sustain conceptual knowledge. Therefore, this dissertation study focuses on teachers' motivating practices that may support reading engagement.

The main goal of this dissertation, therefore, is to identify two motivating practices that may foster engaged reading; they are conceptual press and autonomy support. It is hypothesized that as students' perceptions of these motivating practices

increase, students' engagement in reading will increase and, in turn, as engagement in reading increases, conceptual learning from text for fourth- and fifth-grade students will increase. Thus, I begin by reviewing the literature defining conceptual learning in a general sense and move to what it means to learn conceptual knowledge from expository text in knowledge domains. Next, I discuss the documented relations between engaged reading and conceptual learning from text and the classroom conditions that foster reading engagement. Finally, I review the basis for a hypothesis proposing that the association of motivating reading instruction and conceptual learning from text will not be a direct, but rather, an indirect linkage through a student's engaged reading.

I will use the following schematic (see Figure A) as an advanced organizer throughout this text. I will highlight the section being discussed with regard to definitions and linkages of terms and relations in the model. For example, in the first section of this review, I will give a theoretical definition and discuss relevant empirical research related to conceptual learning from text. Therefore, the circle is shaded grey. At other times in the review, I will discuss relations among constructs, and at those times, the arrows will be shaded. In the following discussion, I focus on the definition of conceptual learning and more specifically, what it means to learn conceptual information from reading expository texts.



*Figure A.* Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text.

*What is Conceptual Knowledge?*

Knowledge refers to all of the information that someone possesses about any specific concept, including everyday naïve theories, as well as formal scientific theories of a domain (Alexander, 1992; 1996; 1998b). Conceptual knowledge in a domain is multi-layered and coherent (de Jong & Ferguson-Hessler, 1996), and refers to a richly interconnected set of concepts and relations among concepts (Chi et al., 1994; deJong & Ferguson-Hessler, 1996). These relations could range from a micro-level, wherein understanding would take the form of examples and non-examples of an idea (Klausmeier, 1992), to a macro-level, wherein understanding would involve multiple features and functions, taxonomic and hierarchical relations, and networks of principles that govern a domain (Chi et al., 1994; Guthrie & Scaffiddi, 2004).

For example, at a micro-level of understanding, a child would be able to discern a dog from a bird. The concept "dog" may be defined by its corresponding features, such as fur, wet nose, legs, or tail. These features are the basic building blocks that are used to

create concepts. However, the conceptual knowledge an individual possesses is not simply an accumulation of these basic facts. Conceptual knowledge also reflects a macro-level of understanding, which suggests that students can organize knowledge into a hierarchy of identifying subordinate and superordinate categories, as well as features, functions and relations in an organized system. For example, biology students possessing conceptual knowledge could identify a feature of the heart, such as the septum, and understand its function and relations between and across other parts of the circulatory system (Chi et al., 1994).

Along with the micro and macro understanding comprising conceptual knowledge, students also need to understand that there exist multiple, often rival, viewpoints within a domain of knowledge (Alexander, 1998a; Chinn & Brewer, 1993; Perkins & Simmons, 1988). Alexander (1998a) explained that how a domain of knowledge is communicated, either through a teacher or an author, depends on an individual's definitions and perceptions about that domain, and thus reflects what may or may not be learned by the student. Therefore, empirical evidence supports the importance of exposing students to the diverse viewpoints of a domain and helping them to search for ideas in multiple texts (Hynd, 1998). For instance, Guthrie and his colleagues (1996) found that students' ability to search through multiple texts in order to learn and organize new information was associated with high levels of conceptual learning from text.

It has also been suggested that a person's concepts are the result of his or her prior experiences with the world (Alexander, Kulikowich, & Schulze, 1994; Dochy, Segers, & Buehl, 1999; Pazzani, 1991). These experiences provide personal theories about the imperceptible characteristics of an object, or the causes and effects and inner workings of

a system. When concepts are learned, it is not only because incoming information was appropriately assimilated, it too is because the learner's personal knowledge and experience is being invoked. Therefore, prior knowledge plays an important role in conceptual learning.

In summary, conceptual knowledge in a domain includes: (a) prior knowledge of the domain; (b) a large volume and coherence of basic facts (e.g., structures and features of a concept); (c) networks of relational and hierarchical structuring of the facts; (d) a well-defined understanding of the principled abstractions that govern and explain the concept; and (e) an awareness of multiple viewpoints and models from the domain. In the following section, I define what it means to learn conceptual knowledge from text.

### *Conceptual Learning from Text*

In their work, Graesser and Britton (1996) defined text understanding as "the dynamic process of constructing coherent representations and inferences at multiple levels of text and context, within the bottleneck of a limited-capacity working memory" (p. 350). Indeed, comprehension involves connecting incoming textual information with prior knowledge in such a way that a coherent and stable representation of the passage is constructed (Guthrie & Scaffidi, 2004). Also, conceptual learning from text requires the reader's recognition of main ideas and supporting details, generation of inferences, and reconciliations of multiple interpretations of text (Alexander & Jetton, 2000). One of our goals as educators is to help readers move from simple recall of facts to the construction of internal, coherent representations of meaning (Kintsch, 1988; 1992; Snow, 2002).

In order to differentiate conceptual text learning from mere recall of text, Kintsch and van Dijk (1978) developed a theory of expository text comprehension (see also,

Kintsch, 1990; 1992; 1994). In this model, Kintsch defined three levels of text representation: a linguistic model, a text base model, and a situational model. The linguistic representation comprises the meaning of specific words in memory, often at a verbatim level. At this level of meaning, the reader typically recalls explicit information and preserves the surface structure of the text. At this level of text representation, content from the text is subject to rapid decay.

The text-base representation includes information expressed in the text that is organized such that it remains relatively faithful to the passage. Though the text structure may be modified to emphasize the more important information from the text, this representation consists of the direct textual propositions, along with necessary inferences that satisfy coherence among the propositions. This representation is more stable than the linguistic level of representation because it contains a macrostructure that ties the main ideas together and a microstructure that reflects the interrelated semantic details of the passage.

The situational level of representation captures readers' integration and restructuring of text information such that it has connected meaningfully with prior knowledge. The situational model shows a higher-level integration process wherein vital information is inferred and made part of the representation. Thus, the reader gains a deeper understanding of the material, resulting in the transfer of knowledge to novel situations and problem-solving tasks (Kintsch, 1988; 1992). It has been demonstrated empirically that it is possible to discriminate among these levels of representation (Mannes & Kintsch, 1987). Although this model has been extended upon by various

researchers (see Britton & Graesser, 1996), it remains one of the more useful theories with respect to delineating levels of conceptual knowledge acquired from expository text.

How do we know when students have generated the essential connections in order to represent the integrated knowledge described in the situational model of text learning? Michelene Chi and her colleagues' work (1994) have been particularly informative in describing the organization and quality of conceptual knowledge gained from text. The degree to which knowledge is connected and integrated depends on the number of connections between nodes of knowledge. Nodes are connected with regard to structures, functions, and relations. Using the atrium, a feature of the heart, as an example, Chi and her colleagues (1994) described differing nodes of knowledge that must connect and co-exist in order to achieve conceptual understanding. She explained that the local features of the heart include a structural property, a behavioral component, and a functional aspect. For example, the atrium is a muscular chamber, which squeezes blood and acts as a holding bin. The connections between these three components represent one network of relations. As the web of relations expand, however, the reader understands connections among the various features and begins to form hierarchical relations. The greater the number of connections, both at the micro-level (between structures) and at the macro-level (among structures), ultimately defines the level of conceptual learning.

In a study of eighth-grade students, Chi and her colleagues (1994) developed a rubric for identifying the different levels of conceptual knowledge that students gained from reading text. Students read a passage about the circulatory system and answered comprehension questions based on the reading. Their answers were coded into five categories. At the lowest level of understanding, students identified one or two features or

structures of the heart that were explicitly stated in the text. As students progressed to higher levels of conceptual understanding, they were able to accurately convey relations, processes, or connections between and among the heart and lungs, and they were able to make inferences based on the text reading. For example, students at a knowledge inference level (i.e., Kintsch's text base level) were able to identify important features of the circulatory system, and they were able to describe essential relations among the organs involved in the circulatory system.

Still, at the highest level of conceptual learning from text, students illustrated system-wide properties that linked more detailed features and forged new relations among concepts. For example, they described the reciprocity of the lungs, heart, and blood in oxygenating, pumping, and carrying blood to the body. This level of conceptual learning from text represented a volume of facts and an integration of factual relations at a principled level of understanding. Guthrie and his colleagues (2004a) have developed similar rubrics to understand elementary-aged students' levels of conceptual learning from text.

In sum, conceptual learning from text involves facts, relations, and systems that merge into a set of principles that underlie a domain of knowledge. It differs from simple reading comprehension in that it reflects the new information acquired from reading text (Guthrie & Scafiddi, 2004). We know that readers come to a text with an existing knowledge base about a topic, which is referred to in this study as prior knowledge. The outcome of a text interaction includes both a readers' prior knowledge about a topic and the new information learned from a text about that topic. Therefore, in this study,

conceptual learning from text refers to the process of constructing “new” knowledge through interacting with text.

### *Learning from Text in the Science Domain: A Priority*

There are compelling reasons to study fourth- and fifth-grade students’ conceptual learning from expository text in the knowledge domain of science. First, there are limited studies focusing on student learning from expository text in the context of science.

Whereas many studies have focused on particular attributes of expository text across domains (i.e., refutational text, Guzzetti & Hynd, 1998), few have looked at how motivating teaching practices, particularly in the domain of science, foster conceptual learning from text (see Guthrie et al., 2004a, for exceptions).

Whereas many science educators place the role of text as subordinate to other inquiry science methods, such as experimentation (Linn et al., 2000), empirical evidence indicates that experimentation is necessary, but not sufficient, for growth in conceptual knowledge. In fact, one does not simply supplant the other. For example, evidence indicates instructional practices that support both the reading of multiple expository science texts and the use of experimentation and hands-on methods result in higher conceptual learning from text (Guthrie, Wigfield, Humenick, Perencevich, Taboada, & Barbosa, 2004). It is particularly important to study other instructional practices in reading that may foster conceptual learning from expository text in the science domain.

### *Conceptual Learning from Expository Text is Difficult*

Comprehending text is a difficult and laborious activity. Edward Thorndike (1917) recognized the complexity involved in comprehension when he noted,

Reading is a very elaborate procedure, involving a weighing of each of many

elements in a sentence, their organization in the proper relations one to another, the selection of certain of their connotations and the rejection of others, and the cooperation of many forces to determine the final response. The mind is assailed as it were by every word in the paragraph...It must select, repress, soften, emphasize, correlate and organize all under the influence of the right mental set or purpose or demand (pp. 323, 329).

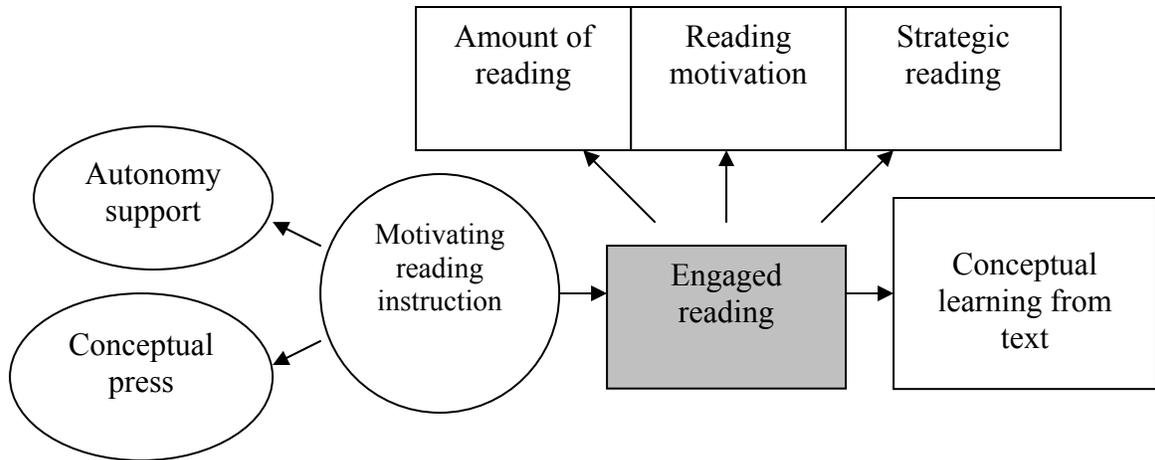
There are many reasons why students have difficulty gaining knowledge from expository text. Prior knowledge plays a powerful role in organizing incoming information and has been well documented to influence conceptual learning from text (Alexander et al., 1994; Anderson & Pichert, 1978). There is substantial evidence regarding the important role of prior knowledge during text learning (Alexander & Jetton, 2000; Dochy et al., 1999). For example, in a classic study, Anderson and Pichert showed how prior knowledge influenced readers' comprehension of a text. Groups of wrestlers and music students read text passages that could have been interpreted in one of two ways. In the first passage, the main character could have been interpreted as a wrestler or a prisoner, and in the second passage, an event could have been interpreted as a card game or a musical concert. The music students interpreted the first passage to be about a prisoner's escape and the second passage to be about a musical performance. In contrast, the wrestlers interpreted the first passage to be about a wrestler escaping a hold, whereas they thought the second passage was about a card game. Indeed, prior knowledge contributed greatly to the readers' interpretations of these texts.

However, many students come to an expository reading task with little or faulty prior knowledge, or in many cases, they simply do not activate relevant prior knowledge

(Alexander et al., 1994; Hanson & Pearson, 1983). In addition, expository text is generally written to inform a reader about new a topic; thus, by definition, readers have little or no prior knowledge about the topic (Perkins & Simmons, 1988). Therefore, a difficulty students may have in reading to gain conceptual knowledge from text is that they may have a minimal foundation of prior knowledge for assembling a coherent representation of the text. An additional obstacle stems from readers not activating accurate, relevant or important prior knowledge given the textual topic (Chinn & Brewer, 1993). In short, insufficient, irrelevant, or even faulty prior knowledge can have powerful effects on comprehension outcomes, particularly when students are reading expository texts on unfamiliar topical domains, which is often the case in the domain of science.

A second reason why students may struggle when reading to gain knowledge from expository text is that reading in the early grades tends to focus on narrative, rather than expository text structures (Dreher, 2000). Traditional views of reading instruction had established the idea that students should learn to read storybooks first, and when that skill is well acquired, they could move to more complex informational text structures, and read to learn. There is an emerging awareness that students at younger ages should encounter both information and narrative text structures (Duke, 2000; Snow, 2002). However, the shift from reading narrative to reading expository text can be debilitating, as students may lack necessary reading strategies for understanding expository text. For example, Dreher and her colleagues (1998) found that before implementing an intervention on strategic reading, fourth-grade students rarely mentioned using an index or table of contents as an effective strategy for finding information in a book. Along with limited strategies for understanding expository texts, students may also lack the

motivation to persist when the reading inevitably becomes more difficult, as it does in fourth and fifth grade (Guthrie & Wigfield, 2000). Because learning from expository text is complex and difficult, students need to be engaged in reading. In the next section, I discuss the definition of reading engagement.



*Figure B.* Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text: The role of engaged reading

### *Defining Engaged Reading*

Since conceptual learning from text requires strategy use, sustained effort and persistence, and the desire to understand text, students need to be engaged during reading. The term engagement has come to comprise many meanings in the literature (Fredericks et al., 2004; Furrer & Skinner, 2003; Guthrie, Wigfield, Barbosa et al., 2004; Kirsch, deJong, LaFontaine, McQueen, Mendelovits, & Monseur, 2002; Skinner, Zimmerman-Gembeck, & Connell, 1998; Sweet, Guthrie & Ng, 1998). Skinner and her colleagues suggested that both behavioral and affective components are included in engagement processes. For example, Furrer and Skinner defined engagement as “active, goal-directed, flexible, constructive, persistent, focused interactions with the social and physical

environments” (p. 149). In their study, children’s reports of engagement included both behavioral indicators (e.g., working hard and trying) and emotional indicators (e.g., enjoyment of learning, involvement, and interest).

In an international study researching reading performance and engagement, the Programme for International Student Assessment (PISA), defined reading engagement as a concept involving both reading practices and reading attitudes. They identified engaged readers as students who regularly read different kinds of print, had positive attitudes toward reading, and who viewed reading as a source of pleasure and knowledge growth (Kirsch et al., 2002).

In some studies, engagement with regard to behavior has included time on task, concentration, effort, and persistence during the initiation and execution of a cognitive task (Furrer & Skinner, 2003; Skinner et al., 1998). Also, some researchers have pointed to a behavioral aspect of engagement as the frequency of doing an activity, such as reading (Kirsch et al., 2002). Others concurred (Cox & Guthrie, 2001a; Guthrie & Wigfield, 2000) and also identified diversity of reading as an important behavioral aspect of engagement.

Some researchers have also stressed the utilization of cognitive processes as a form of engagement (Guthrie & Wigfield, 2000; Meece et al., 1988). For example, Meece and her colleagues assessed aspects of cognitive engagement that included use of cognitive strategies and metacognitive strategies, such as planning and monitoring. In the domain of reading, Guthrie and Wigfield stressed the importance of strategic reading as an aspect of cognitive engagement. Lastly, engagement with regard to affect refers to the enjoyment and the enthusiasm involved when doing a cognitive task (Furrer & Skinner,

2003). So, too, Guthrie and Wigfield have used aspects of reading motivation to measure some aspects of students' affective engagement (e.g., curiosity and involvement).

Thus, for the purpose of this study, I used a definition of reading engagement that included behavioral, cognitive, and affective components. The engagement perspective of reading describes how multiple self-processes, including motivation, strategic reading, and conceptual knowledge, are coordinated during reading (Baker, et al., 2000; Guthrie, Wigfield, Barbosa et al., 2004; Guthrie & Wigfield, 2000). According to Guthrie and his colleagues (1998) "the term engagement in reading refers to the motivated use of strategies and conceptual knowledge during reading" (p. 261). During reading engagement, affective, behavioral, and cognitive processes are attuned and focused on gaining conceptual understandings in a sustained manner. Engaged readers use reading strategies to search through texts, interpret meanings accrued from reading, and re-visit texts to extend their conceptual knowledge structures (Perencevich, 2004). Moreover, engaged readers use motivational strategies to pique personal interest (Schiefele, 1996), elevate and maintain effort and persistence (Bandura, 1982; 1997), and create personal intentions for learning text material (Pintrich, 2000). Lastly, engaged readers read widely and frequently (Kirsch et al., 2002; Tonks, Perencevich, Wigfield, & Guthrie, 2004).

Since engaged reading is a complex expression of affective, behavioral, and cognitive qualities of the individual, in this dissertation, multiple measures were used to assess students' engagement in reading. The constituents of engaged reading in this study included (a) motivation for reading (i.e., affective), (b) amount and breadth of reading (i.e., behavioral) and (c) strategic reading (i.e., cognitive). In the following sections, I

further define these constituents of engaged reading and discuss the strong relations among these three constituents.

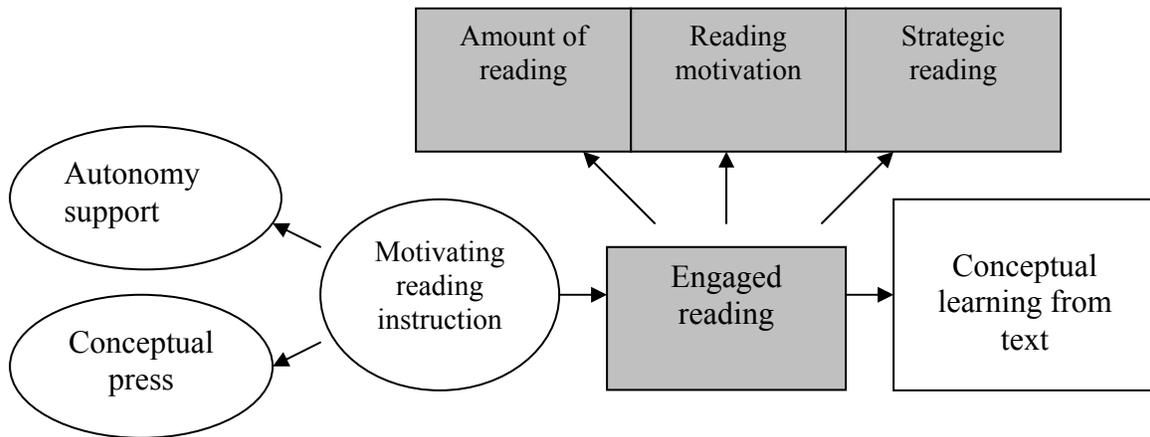


Figure C. Indirect effects model of motivating reading instruction, engaged

reading and conceptual learning from text: Constituents of engaged reading

*Three Constituents of Engaged Reading*

*Affective constituent of engaged reading: Reading motivation.* Qualities of the self-system are main springs of motivated reading behaviors. As Deci (1995) stated, "People are said to be motivated to the extent that they intend to accomplish something...An intention involves a desire to attain some future state along with a means to attain the desired end" (p. 3). Reading is an activity that individuals do for various reasons and those reasons reflect intentions, beliefs, and personal dispositions. For example, students who are curious read widely to learn about the world around them. Students who seek involvement and the experience of getting lost in a book read for the experience of aesthetic enjoyment (Csikszentmihalyi, 1990; Schallart & Reed, 1997). At a given time and in a particular contextual milieu, a reader's intentions can vary and include multiple reasons for pursuing reading activities. This idea has been empirically

confirmed in multiple studies (Wigfield & Guthrie, 1997; Wigfield, Guthrie, Tonks, & Perencevich, 2004). For instance, in a study of primary school children in grades one through three, Gottfried (1990) found that motivation for reading, science, math, and social studies were distinguishable and relatively specific to their content domains.

Recent research in reading motivation has begun to focus on multiple trajectories to reading achievement and the situational determinants that may affect motivation (Guthrie, Wigfield, Barbosa et al., 2004). It is plausible, therefore, that there are multiple motivational aspects of reading behavior, such as curiosity in reading, reading efficacy, involvement in reading, and preference for reading challenge (Watkins & Coffey, 2004; Wigfield, 1997; Wigfield & Guthrie, 1997). Following, I discuss the aspects of reading motivation that were used in this study.

*Aspects of reading motivation.* Reading motivation is multifaceted and complex (Guthrie & Wigfield, 2000; Wigfield, 1997). In this dissertation, I focused on two central aspects of reading motivation, intrinsic motivation to read and reading efficacy. Intrinsic motivation to read involves being interested in a task and having the intent to engage in the task for its own sake (Ryan & Deci, 2000). A large body of research has shown that intrinsic motivation relates to long term engagement in activities, as well as to deeper learning (Ames & Archer, 1988; Benware & Deci, 1984; Graham & Golen, 1991; Ryan & Deci, 2000). Reading efficacy involves students' beliefs and confidence in their abilities to read and persist in reading tasks (Bandura, 1982; 1997). Children's efficacy predicts performance, persistence, and willingness to choose reading activities (see Pajares, 1996 for review).

In this study, aspects reflecting intrinsic reading motivation, consisting of curiosity, involvement, and preference for challenge in reading were used as aspects of reading motivation. These aspects of reading motivation are supported by the general motivation literature (Csikszentmihalyi, 1975; Deci & Ryan, 1985; Harter, 1981; Lepper & Hodell, 1989; Pintrich, 2000). Curiosity in the domain of reading is defined as, "the desire to read about a particular topic" (Baker & Wigfield, 1999, p. 455). Curiosity has long been recognized as an important contributor to engagement processes and as a source of intrinsic motivation (Alexander & Jetton, 2000; Bergin, 1999; Dewey, 1913; Hidi, 1990; Mitchell, 1993; Schiefele, 1996). Akin to interest, curiosity may provide the catalyst necessary for students to begin reading. Curiosity may be aroused by text features, such as a lavish text illustration; a situational classroom event, such as a hands-on experience; a class discussion; or a topical interest.

Involvement in reading refers to a person's immersion in a text (Wigfield & Guthrie, 1997). Involved readers enjoy getting fully engrossed in a book, and/or identifying with a book's theme or character. Involvement has typically been studied as an individual's psychological experience resulting in the enjoyment of an activity (Csikszentmihalyi, 1975; Deci & Ryan, 1985; Reed & Schallert, 1993; Schallert & Reed, 1997). Reed and Schallert found involvement to be associated with deep concentration and an understanding of the task.

Preference for challenge in reading refers to the desire to understand complex ideas from text. Motivated readers tend to prefer texts that they find challenging, whereas non-motivated readers tend to choose easier texts. Preference for challenge has been supported by Csikszentmihalyi's (1990) theory of emergent motivation and White's

(1959) work on effectance motivation wherein they hypothesize that working at the edge of one's competencies increases attention and enjoyment of an activity.

Reading efficacy is another aspect of reading motivation used in this study. Reading efficacy refers to individuals' assessments of their ability to accomplish a task or activity, such as reading a book or passage in a book. The major influences on children's efficacy beliefs are successful previous performance, how well they have done on similar tasks or activities, the feedback they received from others, and encouragement from others (Bandura, 1982, 1997). Researchers have shown that children with high self-efficacy do better on different achievement activities, choose more difficult activities to try, and persist at them even if they are having trouble completing them (see Pajares, 1996 for review).

*Correlations among aspects of reading motivation.* Preference for challenge in reading, reading curiosity, involvement in reading, and reading efficacy have shown moderate correlations in a number of studies (Baker & Wigfield, 1999; Tonks et al., 2004; Wigfield & Guthrie, 1997). For example, Baker and Wigfield (1999) reported significant correlations between each of these aspects of reading motivation. Preference for challenge was significantly correlated with curiosity ( $r = .62, p < .01$ ) and involvement ( $r = .65, p < .01$ ). Curiosity was also significantly correlated with involvement ( $r = .57, p < .01$ ). Similar significant correlations among these aspects of reading motivation were reported in the Wigfield and Guthrie study for both the fall and spring samples. Wigfield and Guthrie also showed that reading efficacy was correlated with preference for challenge in reading ( $r = .51, p < .01$ ), reading curiosity ( $r = .52, p < .01$ ), and involvement in reading ( $r = .51, p < .01$ ).

In some studies, some aspects of reading motivation have been combined to form a composite of intrinsic motivation (Guthrie et al., 2000; Guthrie, Wigfield, Barbosa et al., 2004). For example, Guthrie and his colleagues combined curiosity, involvement, and preference for challenge to form a composite of students' intrinsic motivation ( $\alpha = .86$ ). In another study (Guthrie, Wigfield, Barbosa et al., 2004), curiosity, preference for challenge, involvement, and reading efficacy were combined to represent reading motivation ( $\alpha = .75$ ). For the purposes of this study, I combined the same three aspects of intrinsic motivation for reading and reading efficacy to represent reading motivation and further, the affective and cognitive aspects of reading engagement.

*Behavioral constituent of engaged reading: Amount and breadth of reading.* A second constituent of engaged reading is amount and breadth of reading (Kirsch et al., 2002; Wigfield & Guthrie, 1997). Reading amount and breadth is often defined as wide and frequent reading for a variety of purposes (Cox & Guthrie, 2001a). In this study, reading amount and breadth referred to wide and frequent reading in the domain of science for a variety of purposes. Many researchers have characterized reading amount as voluntary reading (Elley, 1992; 1996; Morrow, 1996); print exposure (Cunningham & Stanovich, 1997), leisure reading (Anderson, Wilson, & Fielding, 1988; Greaney, 1980), and time spent reading (Taylor, Frye, & Maruyama, 1990). It is well documented that students who read frequently and widely have higher reading achievement and possess more knowledge than those students who read less often (Anderson et al., 1988; Cipielewski & Stanovich, 1992; Greaney, 1980; Taylor et al., 1990). For this investigation, reading amount and breadth is the behavioral constituent of engaged reading.

*Cognitive constituent of engaged reading: Strategic reading.* The third constituent of engaged reading is a cognitive quality, which is strategic reading. In reading, strategies are often defined as controllable and intentional processes that help students increase their ability to decode, comprehend, and integrate information across texts (Pressley, 1997). Cognitive research has shown that in order for students to construct meaning from text and gain new understandings about a concept, they must take deliberate control over their reading processes (Baker, 2002; Weinstein & Mayer, 1986). Engaged readers are intentional and aware. They can decide which reading strategy is necessary to apply in a given situation to increase comprehension of the text. They are flexible and able to change their mode of reading operation, if necessary. Engaged readers take into consideration the given task and text and decide which strategies are most appropriate to use in the given circumstance. Lastly, engaged readers realize when their comprehension is breaking down and are able to change their reading strategies to facilitate understanding of the text.

Reading strategies, such as searching for information (Guthrie, Weber, & Kimmerly, 1993) and summarizing (Brown, Day, & Jones, 1983), are two essential tools necessary for learning conceptual knowledge from text. In an extensive review of text comprehension research, The National Reading Panel (2000) identified categories of strategy learning that have a solid scientific basis. Importantly, they noted that multiple strategy use among learners was essential, wherein students learn to coordinate many processes in order to learn conceptual knowledge from text. In order to gain conceptual knowledge from text, readers must be able to search through multiple texts, extract the important details and main ideas, and integrate the information into a coherent, yet

flexible, representation (Guthrie & Taboada, 2004). Therefore, this study measured two specific strategic reading processes: searching and summarizing. Students' use of these strategic reading behaviors represents the cognitive constituent of engaged reading. In the following section, I describe the strong relations among these three constituents of engaged reading.

### *Empirical Relations among the Constituents of Engaged Reading*

A plethora of studies have shown strong relations between the constituents of engaged reading which include, reading motivation, amount and breadth of reading, and strategic reading (Guthrie, Wigfield, Metsala, & Cox, 1999; Pintrich & DeGroot, 1990; Tonks et al., 2004).

*Reading motivation is related to reading amount and breadth.* Numerous studies have shown the relation between reading motivation and reading amount and breadth (Baker & Wigfield, 1999; Cox & Guthrie, 2001a; Guthrie, Wigfield, et al., 1999; Wang & Guthrie, 2004; Wigfield & Guthrie, 1997). For example, Cox and Guthrie found significant correlations between reading amount and breadth in grades three and five and between several aspects of motivation, including curiosity, involvement, preference for challenge, and reading efficacy. Also, in one study, after the effects of previous reading achievement and strategic reading were statistically controlled, reading motivation significantly contributed an additional 12% of the total of the variance accounted for in amount and breadth of reading for enjoyment (Cox & Guthrie, 2001a).

In one study, 105 fourth- and fifth-grade students completed diaries, reporting the number of minutes they read per day, and they completed a questionnaire about their amount and breadth of reading (Wigfield & Guthrie, 1997). Children who possessed

higher intrinsic motivation read more and with more breadth than did their schoolmates, who reported lower intrinsic motivation. In fact, intrinsically motivated students read 29.80 minutes per day, whereas children lowest in intrinsic motivation read only 10.52 minutes per day.

Baker and Wigfield (1999) conducted a follow-up study with 371 fifth- and sixth-grade students in an urban city in order to generalize the findings of the previous investigation conducted by Wigfield and Guthrie (1997). In this study, students were administered the Motivation for Reading Questionnaire (MRQ) and students were asked two questions about their reading activity. Aspects of reading motivation utilized in this study (curiosity, involvement, preference for challenge, and reading efficacy) were significantly correlated with amount and breadth of reading activity.

In another study of 271 third- and fifth-grade students, Guthrie and his colleagues (1999) combined aspects of reading motivation (i.e., curiosity, involvement, and preference for challenge) into one scale in order to predict amount and breadth of reading. Amount and breadth of reading was significantly correlated with reading motivation ( $r = .37$ ), and multiple regression showed reading motivation to account for significant variance in amount and breadth of reading ( $\beta = .383, p < .001$ ). In another study, growth in amount and breadth of reading was strongly predicted by aspects of motivation, such as reading involvement, curiosity, and preference for challenge in reading (Guthrie et al., 2000).

Research done in the U.S. and internationally has shown that reading motivation, measured by student reports of reading engagement and reading attitudes, predicts reading achievement even when the effects of parental occupation and education were

statistically controlled (Guthrie, Schafer, & Huang, 2001; Kirsch et al., 2002). Not only is reading motivation related to reading amount and breadth, it is also related to strategic reading.

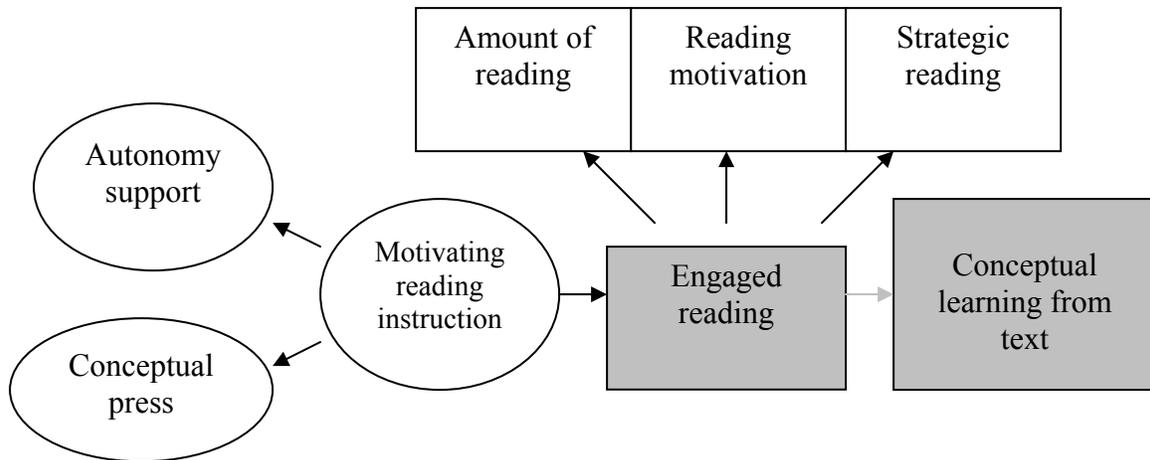
*Reading motivation is related to strategic reading.* In the early 1990's, researchers began to realize that because strategic reading was effortful, volitional, and required persistence, a high level of reading motivation would necessarily be present during strategy use (Paris, Wasik, & Turner, 1991; Pintrich, Marx, & Boyle, 1993). In fact, reading motivation and strategic reading have been shown to have significant correlations in multiple studies (Alao & Guthrie, 1999; de Sousa & Oakhill, 1996; Guthrie, Taboada, Davis, Scaffidi, Perencevich, & Wigfield, 2003; Payne & Manning, 1992; Reynolds & Symons, 2001). For example, one study showed that strategy use in reading science materials was predicted by the strength of students' motivations (Alao & Guthrie, 1999). In studies of Concept-Oriented Reading Instruction (CORI), reading motivation was significantly correlated with strategic reading (Guthrie et al., 1996; Guthrie, Wigfield, Barbosa et al., 2004). Lastly, in an experimental study, students were given a choice about which books to use to search for information (Reynolds & Symons, 2001). Students in the choice condition not only spent more time reading, but used more sophisticated reading strategies to understand the text.

In addition, many researchers studying goal theory have found relations between learning goals and strategic reading (Ames & Archer, 1988; Graham & Golen, 1991). For example, Pintrich and DeGroot (1990) showed that junior high school students who reported high motivational goals also reported using strategies in reading, such as

comprehension monitoring and summarizing. Not only is strategic reading related to reading motivation, it is also related to reading amount and breadth.

*Strategic reading is related to reading amount and breadth.* To participate in wide and frequent reading students need to possess cognitive and volitional strategies (Corno & Randi, 1997). Wide and frequent reading has been shown to be significantly correlated with strategic reading (Cox & Guthrie, 2001a, Wigfield et al., 2004). For example, Cox and Guthrie showed that strategic reading among a total of 251 third- and fifth-grade students was significantly correlated with amount and breadth of reading, both for enjoyment ( $r = .38, p < .01$ ) and for school ( $r = .26, p < .01$ ).

In sum, since the definition of reading engagement includes cognitive, affective, and behavioral properties, all three of these qualities were used as constituents of engaged reading in this study. Moreover, the fact that these constituents of reading engagement are correlated gives converging evidence for a unitary construct. I have argued that these multi-dimensional constituents are distinct, but mutually supporting processes of engagement and work as a complex system to predict conceptual learning from text. In the following section, I discuss the empirical evidence linking engaged reading and conceptual learning from text. However, since few studies have combined these particular constituents, I discuss the research regarding each constituent with conceptual learning from text. First, I present the research for the relations between reading motivation and conceptual learning from text. Second, I present the research linking amount and breadth of reading and conceptual learning from text. Finally, I discuss the important relations between strategic reading and conceptual learning from text.



*Figure D.* Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text: Relations between engaged reading and conceptual learning from text

*Engaged Reading is Associated with Conceptual Learning from Text*

In this study, engaged reading has been defined to include reading motivation, strategic reading, and amount and breadth of reading. In the following section, I discuss the relations among each constituent of engaged reading with reading comprehension.

*Reading motivation is related to reading comprehension.* Reading motivation is associated with reading outcomes in general, such as grades, recall of reading passages, standardized achievement tests, and reading comprehension tests (Baker & Wigfield, 1999; Gottfried, 1990; Guthrie, Wigfield, Barbosa et al., 2004; Schraw & Dennison, 1994; Wade, Buxton, & Kelly, 1999). With regard to reading achievement, as measured by a standardized test and reading grades, Gottfried (1985, 1990) showed positive, significant correlations between intrinsic motivation and reading achievement. In her studies, intrinsic motivation was conceptualized as an orientation toward learning, curiosity, persistence, task endogeny, and preference for challenging, difficult, and novel

tasks. In addition, reading achievement was measured in two ways, with teacher-rated performance indicators and with a standardized reading test.

In studies where teachers are trained to use motivational practice fused with strategy instruction (i.e., CORI instruction), students had higher outcomes on reading achievement measures, including performance assessments measuring conceptual learning from text, and traditional standardized reading measures, such as the Gates MacGinitie test (Guthrie, Wigfield, Barbosa et al., 2004). A positive effect size of .43 for CORI was also observed for traditional passage comprehension and recall tasks that included both informational and narrative texts (Guthrie et al., 1998). Taken together, the evidence suggests that reading motivation contributes positively to reading outcomes, including conceptual learning from text.

*Amount and breadth of reading is related to conceptual learning from text.*

Amount and breadth of reading is important because it enhances both reading comprehension and conceptual learning from text. Among elementary school children, reading comprehension has been substantially predicted by amount and breadth of independent reading (Anderson et al., 1988; Cipelewski & Stanovich, 1992; Greaney, 1980; Taylor et al., 1990). This significant contribution has been documented with a wide variety of indicators, including activity diaries (Anderson, et al., 1988; Greaney, 1980; Wigfield & Guthrie, 1997), self-report questionnaires, such as the Reading Activity Inventory [RAI] (Wigfield et al., 2004), and measures of print exposure, such as title recognition tests [TRT] and author recognition tests [ART] (Cunningham & Stanovich, 1997).

Empirical evidence suggests that amount and breadth of reading is significantly correlated with reading comprehension (Cox & Guthrie, 2001a; Ortiz, 1986). For example, Ortiz showed that time and frequency of reading correlated with reading comprehension of Grade four students on the National Assessment of Educational Progress (NAEP). Likewise, in a study of 155 fifth-grade students, Anderson and his colleagues (1988) asked students to complete activity diaries indicating how many minutes they spent reading outside of school. Interestingly, the researchers showed that children who scored at the 90<sup>th</sup> percentile on a reading standardized test spent an average of five times as many minutes reading than children in the 50<sup>th</sup> percentile scoring range. Moreover, when compared to children in the 10<sup>th</sup> percentile, the high scoring students read more than 200 times as many minutes per day. In this investigation, time spent reading outside of school accounted for 16% of the variance in reading comprehension.

It may seem obvious that children who read widely and frequently are high achievers. However, amount and breadth of reading is not only correlated with achievement in a simple association, but is a source of growth in reading comprehension (Cunningham & Stanovich, 1991; Echols, Stanovich, West, & Zehr, 1996). For example, Cunningham and Stanovich (1997) argued that amount of time reading and breadth of reading sources, as measured by print exposure techniques, is a causal factor in reading achievement (see Cunningham & Stanovich, 1997 for a review). In a series of longitudinal investigations, using multiple control variables, Stanovich and his colleagues (Cipielewski & Stanovich, 1992; Cunningham & Stanovich, 1997; Stanovich & Cunningham, 1993) have shown that wide and frequent reading (measured by print exposure) accounts for growth in reading comprehension and knowledge gains. In a two-

year longitudinal study following students in grades 3, 4, and 5, fifth-grade students' amount and breadth of reading predicted reading comprehension after controlling for the effects of prior achievement, prior amount of reading, intelligence, and parental income (Cipielewski & Stanovich, 1992).

It is plausible that students who read frequently and widely should also gain knowledge about the topics and domains in which they read and this expectation has been confirmed (Cunningham & Stanovich, 1991; Cipielewski & Stanovich, 1992; Greaney, 1986). In another two-year longitudinal study of upper elementary children, Echols and her colleagues (1996) found that amount of reading predicted growth in general knowledge, after controlling for the effects of age, recognition memory, and previous performance in same cognitive competency area. In this investigation, the control variables of age, memory, and previous performance accounted for 49% of the variance in general knowledge. After controlling for the effects of two previous administrations of the print exposure measure, amount of reading still contributed an additional 4% of the variance in general knowledge. These data permit the inference that amount of reading predicted growth in reading comprehension and knowledge acquisition (Allen, Cipielewski, & Stanovich, 1992; Cipielewski & Stanovich, 1992; Cunningham & Stanovich, 1991).

Several studies have also shown that the increase in reading comprehension during an academic year, from fall to spring, is predicted by children's amount of reading (Cipielewski & Stanovich, 1992; Guthrie, Anderson et al., 1999). For instance, in a study of 117 third-grade students and 154 fifth-grade students, Guthrie and his colleagues found that reading for school and reading for enjoyment predicted passage

comprehension and conceptual learning from text on a performance assessment task. Children completed the Reading Activity Inventory (RAI), wherein they recorded the frequency and breadth of their school and enjoyment reading. After controlling for the effect of past achievement (36% of variance accounted for) and the effect of prior knowledge (an additional 5% of variance accounted for), reading amount significantly accounted for an additional 1% of the total variance accounted for in passage comprehension ( $\beta = .13, p < .05$ ). Moreover, after controlling for the effect of prior knowledge (14% of variance accounted for) and the effect of past achievement (an additional 3% of variance accounted for) reading amount significantly accounted for an additional 2% of the total variance accounted for in conceptual learning from multiple texts ( $\beta = .15, p < .05$ ).

In classroom and school settings, students' time engaged in reading is a stable predictor of reading comprehension (Morrow, 1996; Taylor et al., 1990). For example, in a study of 195 fifth-grade students, Taylor and colleagues showed that amount of school reading was significantly correlated with reading comprehension. Moreover, Postlethwaite and Ross (1992) showed that frequency of borrowing books from the school library, time spent reading in school, and amount of voluntary reading at home predicted reading achievement of nine-year-olds. Taken together, this evidence indicates that amount and breadth of reading contributes to reading comprehension and conceptual learning from text and is supported by a network of cognitive and contextual supports within the classroom.

*Strategic reading is associated with conceptual learning from text.* A number of empirical studies on strategic reading indicate its important benefits on comprehension

and conceptual learning from text (National Reading Panel, 2000; Pressley et al., 1992; Rosenshine & Meister, 1994; Rosenshine, Meister, & Chapman, 1996). For example, in a meta analysis, Rosenshine and Meister (1994) found that the reading strategies taught in a reciprocal teaching context had significant benefits on students' reading comprehension. Across 16 studies analyzed, there was an overall effect size of .14 on standardized tests favoring reciprocal teaching over control programs, but even more interesting was that when the experimental condition included the teaching of strategies in conjunction with reading texts, the effect sizes increased in range from .34 to .60. In this study, strategic reading consisted of students' ability to (a) search for information; (b) extract information from multiple texts to answer a broad conceptual question; and (c) write summaries of text sections read.

Efficient searching for information through multiple documents has been linked with conceptual learning from text (Guthrie et al., 1993). Searching for information refers to students finding information in text through forming goals, selecting appropriate selections of text to read, extracting accurate information, and combining old and new information in a coherent form (Dreher & Sammons, 1994; Guthrie et al., 1993; Taboada & Guthrie, 2004). In a verbal protocol analysis study (Guthrie et al., 1993), 16 students were given local and global questions to answer. To answer the questions, students needed to search each of four illustrations and four graphs. Students were asked to think aloud during their search. Think aloud protocols were coded into various categories including selecting appropriate documents, making appropriate abstractions from text, summarizing, and making appropriate generalizations across text. This study showed that

students who were competent in searching globally for information also learned information from the text.

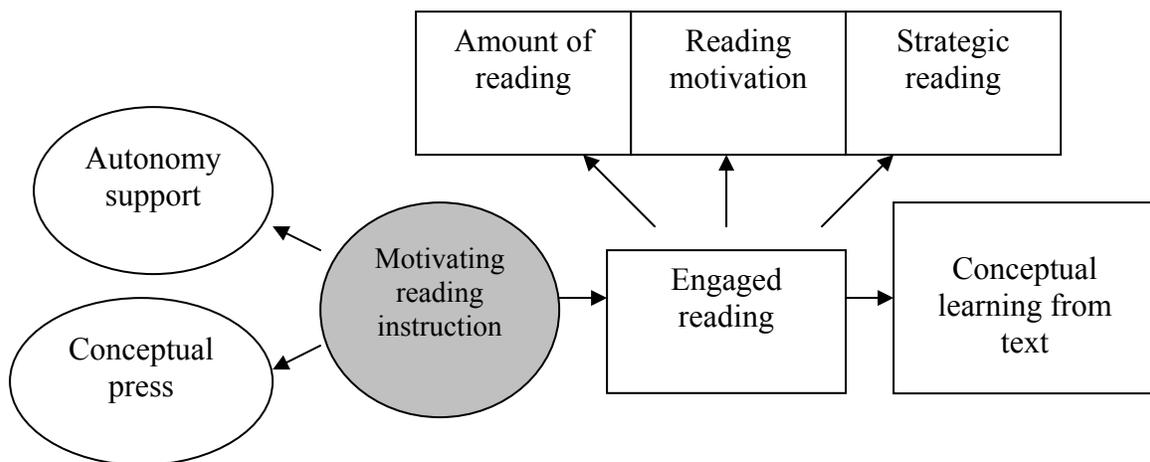
Also, students' ability to summarize during and after reading has shown positive results in increasing conceptual learning from text (Brown, Pressley, Van Meter, Schuder, 1996; Palincsar & Brown, 1984). Summarizing refers to students' creation of an accurate representation of text after reading it (Brown & Day, 1983). In a meta-analysis, Rosenshine and Meister (1994) found that instruction that stressed summarizing had significant benefits on near and far term transfer tasks. Across 10 studies, the average effect size for near transfer was .88 ( $p < .05$ ) and the effect size for far transfer was .32 ( $p < .05$ ).

In a quasi-experimental study, a CORI and a strategy instruction condition were compared to traditional reading and science instruction with regard to strategic reading and conceptual learning from text (Guthrie et al., 2003). Posttest results in this study indicated that searching for information was significantly correlated with conceptual learning from multiple texts ( $r = .81, p < .01$ ). Moreover, a composite of strategy use, including summarizing, was correlated with conceptual learning from multiple texts ( $r = .93, p < .01$ ) and with local passage comprehension ( $r = .69, p < .05$ ). Taken together, this evidence shows important relations between strategic reading and conceptual learning from text.

In summary, constituents of engaged reading, including reading motivation, amount and breadth of reading, and strategic reading, all contribute significantly to conceptual learning from text. If reading engagement enhances conceptual learning from text, then the question becomes, how does motivating reading instruction support

engaged reading? Students do not routinely come to a reading task fully engaged. Rather, specific teacher supports have much to do with whether students become engaged readers.

In the next section, I describe the theoretical and empirical research that links motivating reading instruction with engaged reading. In this section, I discuss evidence from classroom research that gives support for studying student perceptions about instruction. I also present the channels through which classroom practice might engage students. I also present Self-Determination Theory (Deci & Ryan, 1985) as an organizing framework for understanding how social contexts, such as the classroom, can facilitate student engagement. Finally, I discuss how a self-process model of motivation (Guay & Vallerand, 1997; Skinner, 1991; Skinner & Belmont, 1993) provides theoretical and empirical support for an indirect effects role between motivating reading instruction, engaged reading and conceptual learning from text.



*Figure E.* Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text: The role of motivating reading instruction

### *Why Study Motivating Practices?*

The study of motivating practices is fundamental for many reasons. In a review of the scientific studies on reading from the late 1800's to the 1930's, William S. Gray noted that effective reading instruction encourages the mutual benefits of cognitive, affective and behavioral engagement in the process of comprehending text. Gray stated,

[What is needed is] a clear recognition by teachers that comprehension is an objective of teaching, wide reading for specific purposes, a knowledge of the results of practice in reading to comprehend, an emphasis on the elements on which meaning depends, increasing meaning vocabulary, selecting central thoughts of paragraphs and organizing them in logical sequence, and retaining and reproducing the important points read, developing motives for improvement, securing favorable conditions for practice, and securing persistence in effort (Guthrie, 1984, p. 70).

There have been very few empirical investigations focusing on how specific instructional practices may influence the multiple constituents of engagement described earlier (for exceptions, see Guthrie, Wigfield, Barbosa et al., 2004; Meece, 1991; Turner et al., 1998). With some notable exceptions (Alexander et al., 1994; Wigfield et al., 2004), it is also regrettable that subject matter and content have been largely ignored in studies of student engagement. In this study, motivating reading instruction is examined in a domain specific context (e.g., reading in the science domain). Why is the study of motivating reading instruction important? As previously discussed, it is of critical importance that upper elementary students be able to learn conceptual information from a text. For, it is during the upper elementary years that text learning becomes one of the

primary channels through which individual's gain new knowledge. Further, fourth- and fifth-grade students begin studying more complex topics in the science domain. However, because learning from text is a difficult and effortful pursuit, students must be fully engaged in order for them to gain conceptual understanding during reading. It is important to consider which practices might be associated with reading engagement.

Another reason why motivating practices are so important is that research indicates a significant decline in motivation by the time students reach the fourth- and fifth-grade years (Harter, 1998; Wigfield et al., 1997). For example, in a longitudinal study, Wigfield and his colleagues documented that children's interest in reading decreased significantly over time in each of two cohorts, from first to second grade and from second to fourth grade. It is, therefore, important to identify some of the critical instructional practices that may help to maintain or even heighten fourth- and fifth-grade students' engagement in reading. In this study, I focus on two such practices, conceptual press and autonomy support.

### *The Role of Teacher Discourse and Scaffolding in Fostering Engagement*

Instructional practices that are motivating can focus, elicit, or limit reading engagement through discourse (Cazden, 1986; Turner et al., 1998; Turner et al., 2002) and/or academic activities (Durkin, 1979; Stipek, 1996). That is, embedded in the discourse and academic tasks are elements, which can have a remarkable influence over student engagement and academic outcomes. Recently coined phrases in the literature, such as, "cultures of practice" (Brown, Collins, & Duguid, 1989), "communities of learners" (Brown, 1997), and "co-regulation" (McCaslin & Good, 1996) reflect a shift in recognizing the significance of motivating practice in promoting learning.

A vital element of life in classrooms is the intellectual work that teachers and students share. Observational studies of elementary classrooms have found that some classrooms are characterized by a preponderance of teacher talk and literal questions rather than student involvement in reasoning and higher order thinking (Durkin, 1979; Stefanou et al., 2004; Turner et al., 1998; Turner & Meyer, 1999). In a review of classroom research, Weinstein (1991) found that teacher-led groups were characterized by unnatural conversation rules that narrowed the open-endedness of the discourse. Especially pertinent to this discussion is how instructional discourse supports students' internal regulation of motivated behaviors. Many researchers discuss the important role of discourse as instructional conversations, or scaffolding (Brown, Ash, Rutherford, Nakagawa, Gordon, & Campione, 1993; Collins, Brown & Newman, 1989; Guthrie, Wigfield, & Perencevich, 2004b; Stefanou et al., 2004). In these instructional formats, ideas take precedence over answers, multiple approaches replace algorithms, student and teacher roles give way to co-decision-making, and students maintain a delicate balance between knowledge seeking and acquisition of basic skills.

With regard to academic tasks, Turner (1995) observed 12 first-grade classrooms and identified the activity structures as open or closed structures. Open task structures were characterized as interactive-constructive. Open task structures provided students with opportunities to choose what they read, as well as where and when they read. In open task structures, students could seek help from peers, discuss reading strategies, and manipulate the task to create personal challenges. In contrast, closed task structures were characterized by identical seatwork type tasks, teacher-directed reading groups, and limited control among students to make decisions. Turner found task structure to

significantly predict strategic reading, persistence, and volitional control. For example, 81% of all strategic reading was observed in open tasks, whereas only 19% during closed tasks. In all of the instances of persistence observed, 63% occurred during open tasks versus 37% in closed tasks. Likewise, 70% of the instances of volitional control occurred in open tasks whereas 30% occurred in closed task structures.

### *Students' Perceptions and Engagement Behaviors*

Students' perceptions of their classroom instruction are highly associated with the motivational beliefs and engagement behaviors they adopt (Ames, 1992a; Maehr & Midgley, 1996; Pintrich, 2000; Stipek, 1996). Further, studies have shown that motivating practices are perceived consistently by students (Anderman & Young, 1994; Ryan & Grolnick, 1986; Thorkildsen & Nicholls, 1998). For example, Meece (1991) studied 15 science lessons among five science classrooms in order to characterize practices that had an emphasis on understanding versus an emphasis on performance. In two of the classrooms, the majority of students scored high on a possession of learning goals, whereas in another two classrooms, the majority of students scored very low on their possession of learning goals, and in the fifth classroom, students endorsed a mix of goals. After examining the instructional practices, Meece found that the classrooms had very different qualities. Classroom in which students reported low learning goals had some interesting similarities (a) evaluation was salient, (b) tasks did not include student choice, and (c) understanding the material was not valued. Whereas, in classrooms where students endorsed high learning goals, teachers focused on understanding the material by including personal goals for learning, higher-level strategies for concept development, and downplaying evaluation as an instructional strategy.

Other studies have also found consistencies in students' perceptions of their classrooms. Thorkildsen and Nicholls (1998) found significant between classroom differences on learning goals among students, which suggests that instructional practices were perceived consistently by students. Ryan and Grolnick (1986) found children's perceptions of their classrooms to reflect both classroom and individual difference effects (see also, Anderman & Young, 1994).

Since it is clear that students perceive practices and practices communicate a variety of positive or negative beliefs about motivation and engagement, the question becomes, "What instructional practices have been shown to support students' affective, cognitive, and behavioral engagement?" In the following section, I discuss self-determination theory as a framework for describing how self-processes guide students to engage or disengage in school. Second, I present empirical findings from three programs of classroom research that link specific motivating practices with student engagement.

### *Self-Determination Theory*

Self-determination theory describes the human self-system in terms of three psychological needs that are necessary components of optimal learning (Deci & Ryan, 1985). They are competence, relatedness, and autonomy. In the context of the classroom, the need for competence characterizes students' desire to understand their schoolwork. In 1959, White published a classic paper presenting evidence that an intrinsic need to feel competent is an innate characteristic of all humans. As such, exploration behaviors and attempts at mastery are best explained by this innate need. Piaget (1952) also hypothesized that children are naturally inclined to develop skills and, thus, exhibit a need for competency. The second need, relatedness, involves students' desire for

experiences of belonging, personal support, and security in their school relations (Wentzel, 1999; 2002). Lastly, autonomy involves students' need to make important decisions with regard to the "initiation, inhibition, maintenance, and redirection of activities" (Connell, 1990, p.65). For the purposes of this study, this review will focus solely on competence and autonomy. Ryan and Deci (2000) insisted that to reach high levels of intrinsic motivation, "people must experience satisfaction of the needs both for competence and autonomy" (p. 58). Though important, this dissertation research does not focus on the role of relatedness in academic outcomes.

According to Deci and Ryan (1985), instructional practices can either facilitate or frustrate these psychological needs. The degree to which students perceive classroom events as satisfying those needs helps to determine students' engagement in learning. Accordingly, competence can be facilitated by the provision of structure, challenge and competence-related feedback (Skinner, 1991). Skinner and Belmont (1993) defined structure as "the amount of information in the context about how to effectively achieve desired outcomes" (p. 572). Furthermore, autonomy can be supported through the provision of choice and the removal of external controls, such as pressures or rewards (Deci, 1995).

Self-determination theory provides a description of how children's self-processes, such as competence and autonomy, can be supported in social contexts such as school. This study characterizes two sets of practices that may help facilitate students' competence and autonomy and in turn spur them to engagement. They are conceptual press and autonomy support. In the following section, I describe three programs of classroom research that have been shown to have benefits on student engagement.

*Motivating Instructional Practices Foster Student Engagement*

*Concept-Oriented Reading Instruction* (CORI). Guthrie and his colleagues (2004a) used a classroom intervention emphasizing engagement and conceptual learning in reading and science called Concept-Oriented Reading Instruction or CORI (see Guthrie et al., 2004a for a full description of the intervention). CORI teachers were trained to use eight instructional practices (a) conceptual themes that utilized central disciplinary principles; (b) real-world observation to prompt students' natural inquisitiveness; (c) provision of interesting texts to search through and learn from; (d) support for autonomy wherein students make important decisions about their personal learning inquiries; (e) collaboration support; (f) reading strategy instruction in a functional context; (g) student self-expression; and (h) coherence of teaching objectives.

In a typical CORI classroom, students engaged in four types of learning activities (see also Perencevich, 2004). First, they observed and personalized the learning event. On a given day, students encountered a tangible object centered on a conceptual theme. For example, students hunted for crickets in the midst of a unit on the life cycle. Students then used strategies for observation and began to ask personal questions about the object. In the next phase of instruction, students searched through texts to find the answers to their questions. Within this phase, students were taught explicit strategies for searching effectively. In the third phase, students gathered the materials they found to be relevant to their personal inquiries and they began to comprehend and integrate the information from the multiple texts and sources. Teachers provided extensive guidance in comprehension strategies for reading. In the last phase of instruction, students presented to their classmates the information about which they gained expertise. This was accomplished

using a variety of forms of expression, ranging from presentations to the creation of artifacts.

The CORI model has been examined in three year-long implementation-comparison studies and two 12-week implementation comparison studies (see Guthrie & Cox, 2001; Guthrie, Wigfield, Barbosa et al., 2004; Wigfield et al., 2004). In the three year-long studies (Guthrie et al., 1998, Guthrie, Anderson et al., 1999; Guthrie et al., 2000), both CORI and traditional classrooms were implemented in the same three schools. Teachers were comparable in age and experience, and the same objectives were used in all classrooms. The effects of background reading achievement, conceptual knowledge in the topics of instruction, and gender were statistically controlled in each study. Students were drawn from multinational, low-income, traditionally lower-achieving schools. Teachers were trained in CORI during the preceding summer, and day-long monthly sessions to plan and share instruction were held during the school year. In the year-long studies, Guthrie and his colleagues (Guthrie et al., 1998; 2000) documented benefits on conceptual learning from text, strategic reading, and subsequent reading motivation. As a follow-up, Guthrie and his colleagues (2004) began a series of quasi-experimental studies comparing the CORI intervention to a strategy instruction (SI) intervention and a traditional instruction (TI) intervention. In these intervention studies, CORI also showed significant benefits on conceptual learning from text and reading engagement (Guthrie, Wigfield, Barbosa et al., 2004; Wigfield et al., 2004).

Specifically, CORI had positive effects on conceptual learning from text (see Guthrie & Cox, 2001). This construct was measured by requesting students to write a statement about their understanding of a science topic. Students were also asked to draw

critical elements of the topic. This writing sample was rated using a knowledge rubric for these texts similar to existing rubrics for science concepts (Chi et al., 1994). The effect size for CORI was .42 within the same content discipline (life science) as the instructional discipline. For the processes of constructing knowledge in a new discipline of earth science not taught during instruction, CORI had an effect size of .88. This result indicated that the reading strategies and reading engagement acquired in one content discipline transferred to a new content (Guthrie, Anderson et al., 1999). In a prior investigation, CORI had a positive, indirect effect on conceptual knowledge. In that study, strategic reading mediated the benefit of CORI on knowledge acquisition (Guthrie et al., 1998).

Studies using the CORI intervention have also contributed to reading engagement. For example, Guthrie and his colleagues (2001) used hierarchical linear modeling to test the effects of CORI on students' curiosity and strategic reading. CORI students were significantly higher on curiosity (effect size = 1.94) and strategic reading (effect size = 1.71). Moreover, in multiple studies, CORI students showed significantly higher amount and breadth of reading (Guthrie et al., 1996; Tonks et al., 2004), intrinsic motivation to read (Wigfield et al., 2004), and reading efficacy (Wigfield et al., 2004) when compared with students in control classrooms. In the CORI program, many instructional practices were used to promote engaged reading and conceptual learning from text, including practice to foster personalization and choice, and practice to help extend students' competencies for gaining new information from text. Following is a description of another program that also promoted a conceptual emphasis and autonomy support in learning and benefited students' engagement and learning from text.

*Computer-Supported Intentional Learning Environments (CSILE)*. CSILE (or Knowledge-Building Communities) is a classroom intervention that has successfully increased student motivation and conceptual learning (Bereiter & Scardamalia, 1989; Ryser, Beeler, & McKenzie, 1995; Scardamalia et al., 1994). The primary means of building collective knowledge (see Popper, 1972) involves student construction of written dialogues via a communal computer database.

During a typical day in a CSILE classroom, students research topics using the computer for 30 minutes per day in which they can browse through expert and classmates' notes and information, attach notes and graphics found in the database, and record information found through other avenues. Other students may be simultaneously using multiple text sources to gather information. Students can post personal inquiries in the database to which other students can respond; thus an ongoing communication among students provides the impetus for collective knowledge growth. Once students have learned about a topic in depth, they may submit their learned information to the whole class via the database. The database as a whole becomes a class final product, to be viewed by other audiences. The teacher's role in a CSILE environment is one of facilitator. The teacher facilitates the use of the technology, as well as the discourse surrounding the ideas being learned. Expected outcomes of students who participate in CSILE classrooms include the creation of ideas that are new to them and the sharing of these ideas with knowledgeable peers and others.

In a series of studies (e.g., Oshima, Scardamalia, & Bereiter, 1996; Scardamalia et al., 1994), the effects of CSILE on students' ability to construct knowledge from text was tested. In one study, Scardamalia, Bereiter, and Lamon (1994) reported that in comparing

the experimental CSILE group with a control group receiving traditional instruction, the experimental group significantly increased their conceptual learning from text and their reading engagement. First, students significantly enhanced their depth of explanation about a conceptual theme of study. In addition, students increased their ability to represent knowledge learned from text in multiple forms, including graphics. Students also increased their ability to read text and solve an analogous problem. Moreover, with regard to their motivational beliefs about learning, at the end of the study, CSILE students reported more learning-oriented beliefs (71% versus 50%) and reported that they learned something they did not know before (80% versus 56%). In contrast, 40% of control students reported that learning means getting a good grade. Interestingly, only 15% of CSILE students associated good grades with learning.

What were CSILE students doing to increase their conceptual learning and motivation? An analysis of 29 fifth-and sixth-grade CSILE students' cognitive actions in the computer environment revealed that students' usage of the computer system resulted in differential conceptual learning (Oshima et al., 1996). Students, who treated the information flow as unidirectional, from the perceived authority to themselves, learned considerably few principles and relations. In contrast, students who sought to construct meaning in the interchange of textual information gained significantly higher levels of knowledge. These students questioned and rebutted information and acted as co-creators of the knowledge. In addition, high conceptual learners wrote fewer notes that were integrated and coordinated based on the principles and examples of the domain, whereas low conceptual learners wrote many fragmented notes.

In the CSILE program, many teaching strategies were used to promote engaged reading and conceptual learning from text. Among them included strategies to promote knowledge about the facts and principles guiding a domain. By asking students to create multiple graphic representations of their knowledge, students participated in reorganizing their incoming information. Following is a description of another program that promotes a conceptual emphasis and autonomy support in learning and has shown benefits on student motivation and conceptual learning.

*Fostering Communities of Learners* (FCL). Brown and Campione (1990; 1994; 1998) designed a discussion-based curriculum to build transferable science knowledge in elementary-level science classrooms. FCL is grounded in the idea that professional communities of scientific experts often share knowledge through team investigation and evidence-based reasoning, and these activities should be a model for classroom learning in science. The general philosophy was that students control their learning by researching some subset of a topic of inquiry (i.e., insects), share their expertise with classmates, and produce an artifact based on the content studied. Thus, the primary means of gaining knowledge is small and large group discussions built around student reading and writing. The expected outcomes for students who participate in FCL are building transferable knowledge, developing complex reasoning skills, and evaluating scientific thinking.

In one study, three groups of fifth-grade students were compared with regard to conceptual learning outcomes (Brown & Campione, 1994). An experimental group received instruction characterized by a jigsaw approach (see Aronson, 1978) to learning sub-themes of a conceptual unit. During various phases of learning, students were involved in three participant structures (a) composing on the computer, (b) conducting

research, and (c) interacting with the teacher. In these structures, jigsaw groups worked simultaneously on sub-topics of a conceptual theme. Students gathered and presented findings to each other and engaged in asking questions of peers and clarifying concepts. Finally, an expert in the domain (scientist or teacher) gave a presentation to the class. The experimental group received this type of instruction for 3 conceptual thematic units. A partial control group received this type of instruction for 1 conceptual unit and traditional science instruction for 2 conceptual units. A control group received traditional instruction for all 3 units. On assessments of conceptual knowledge growth, the research group and partial control group received higher scores on unit 1 than the control group. On units 2 and 3, the research group performed better. However, the partial control group scored better than the control group on both units.

Although no inferential statistics were reported in the FCL studies, Brown (1997) submitted that students gained deep level understandings about the scientific topics of study as expressed in problem solving by analogy tasks, creating multiple solutions in creating artifacts about life sciences, and displaying deep, coherent knowledge. For example, from one-on-one interviews Brown and her colleagues (1993) provided a number of examples of FCL students developing deeper understandings and giving complex explanations of scientific phenomena. In addition, through student dialogues, Brown and Campione (1994) showed evidence of students' causal reasoning, use of evidence and prediction, and students' development of higher order questioning as a result of participating in FCL.

Taken together, these studies show the powerful effects of a conceptual press in instruction and autonomy support. In each of these programs, students were given

opportunities to experience moderate challenge, and opportunities to reorganize incoming information (i.e., CSILE students made graphic representations on the computer and CORI and FCL students used projects to display their knowledge). Furthermore, through a variety of avenues, including discourse journals and discussion, students had opportunities to recognize important relations between the facts and principles of a conceptual theme. Moreover, each of the programs fostered autonomy by providing students with choices and latitude over the direction of classroom events. Although each of the program interventions resulted in high reading engagement and conceptual learning from text, it is difficult to know which motivating practices were particularly beneficial.

This dissertation study will extend these studies by measuring students' perceptions of two motivating reading practices, conceptual press and autonomy support, and by measuring how these particular practices influence the cognitive, behavioral, and affective constituents of reading engagement. In the next section, I define the motivating practice of conceptual press (Cox & Guthrie, 2002) in the domain of reading, and I describe some empirical studies that connect it to reading engagement.

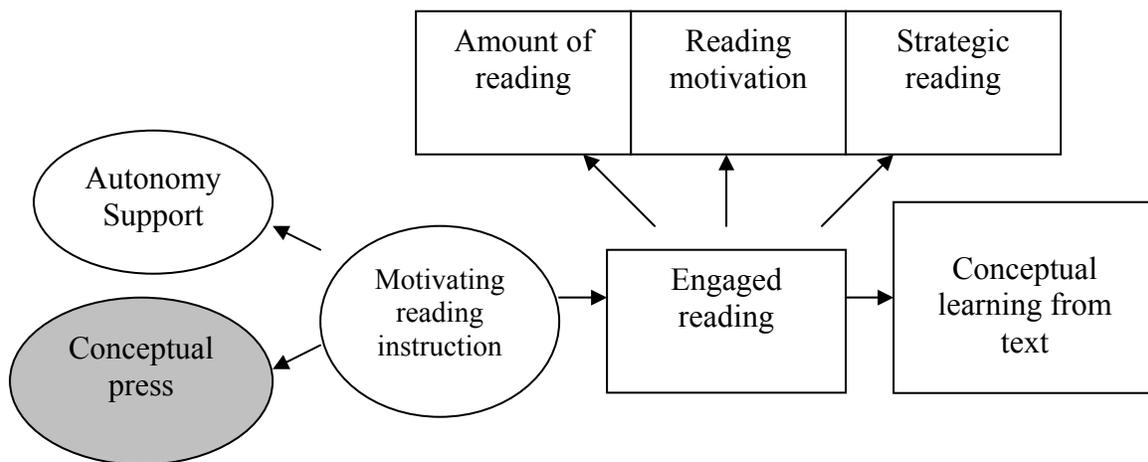


Figure F. Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text: The role of conceptual press

### *Conceptual Press Fosters Reading Engagement*

Based on information from self-determination theory and empirical studies in the classroom, I have identified a set of motivating practices that I believe will foster engagement in reading (Cox & Guthrie, 2002). In my work, conceptual press refers to occasions for students to (a) integrate facts and principles of a domain (Alexander, 1998a; Baxter, Elder, & Glaser, 1996; Bransford, Franks, Vye, & Sherwood, 1989; Chi et al., 1994; deJong & Ferguson-Hessler, 1996); (b) reorganize incoming text information into different forms (Brown, 1997; Scardamalia et al., 1994); and (c) persist in the face of moderately challenging reading tasks (Csikszentmihalyi, 1997; Turner et al., 1995; Turner et al., 1998). In the following sections, I provide definitions and empirical support for three qualities of conceptual press that may be associated with reading engagement.

*Integrating facts and principles of a domain.* Brown (1997) maintained that "one cannot expect students to invest intellectual curiosity and disciplined inquiry on trivia. There must be a challenge; there must be room to explore, to delve deeply, to understand

at ever deepening levels of complexity" (p. 407). The first quality of conceptual press centers on providing occasions for students to integrate facts and principles of a domain. Instruction that helps students move flexibly between facts and principles of a domain is important for conceptual understanding (Alexander, 1998a). For example, it is important for students to distinguish among various features of an animal (e.g., fur or claws); however, it is equally critical for them to understand how these features relate to adaptation, and how such systems of relations communicate principles of ecology (Chi et al., 1994; Guthrie & Scaffidi, 2004).

In an investigation of fifth-grade science students, Baxter and her colleagues (1996) described highly competent students as ones who "provided coherent explanations based on underlying principles, rather than descriptions of superficial features or single statements of fact" (p. 134). Brophy (1999) also advocated that content be organized around "a limited set of powerful ideas (basic understandings and principles)" (p. 80). Teachers who emphasize this quality of conceptual press may use multiple examples to explain concepts. They may ask students to distinguish between main ideas and supporting facts when reading and discussing text, and they may use many text sources to help students identify and integrate facts with appropriate concepts.

When teachers create opportunities for students to navigate between the factual propositions and the principles of a concept, students show evidence of reading engagement (Chi et al., 1994; Chinn & Brewer, 1993; Mayer & Anderson, 1992; Novak, 1998). Students facile in integrating facts and principles of a domain will be able to generate connections among facts and principles when reading, recognize and reconcile discrepant incoming information, organize textual information, and discern relations

among relevant ideas in the domain (Cox & Guthrie, 2002). In the following section, I review the empirical evidence linking the practice of integrating facts and principles of a domain with engaged reading.

*Graphic organizing supports the integration of facts and principles.* Graphic organizing facilitates meaningful learning by requiring students to integrate information from the text into existing knowledge structures (Lonka, Lindblom-Ylänne, & Maury, 1994; Taboada & Guthrie, 2004). Concept maps are graphic representations of a student's knowledge (Novak, 1998). They organize concepts in a hierarchical fashion to represent the relations among ideas. Concept maps have been used to represent a variety of content domains (Horton et al., 1993; Novak, 1990) for all age levels (Novak, 1990; Novak, Gowin, & Johansen, 1983; Stice & Alvarez, 1987).

Concept mapping affects the structure and organization of students' knowledge by increasing their awareness of relations among concepts (Heinze-Fry & Novak, 1990; Novak, 1995; Novak & Musonda, 1991). In a meta-analysis of 10 studies using concept maps as instruction tools, Horton and colleagues (1993) found that while the effect sizes for teacher versus student-prepared maps were similar, the greatest effect size was observed for student-constructed maps in which students identified key terms. Since students were asked to specify the hierarchical relations and create valid links among concepts, it was a significant predictor of text comprehension and conceptual learning from text (Bascones & Novak, 1985; Heinze-Fry & Novak, 1990; Okebukola, 1990; Okebukola & Jegede, 1988; Pankratius, 1990; Stevensvold & Wilson, 1990).

Concept mapping has also been linked to affective aspects of reading engagement (Bascones & Novak, 1985; Heinze-Fry & Novak, 1990; Horton et al., 1993; Novak,

1990). Students who used concept maps tended to have more positive attitudes toward learning (Horton et al., 1993; Novak et al., 1983) and decreased levels of anxiety (Alaiyemola, Jegede, & Okebukola, 1990; Jegede, Alaiymelo, & Okebukola, 1990) compared to students who did not use concept maps in their classrooms. Thus, graphic organizing (or concept mapping) is one practice used to foster reading engagement because it helps students explicate the relations among facts, concepts, and principles of a domain.

*Explanation supports the integration of facts and principles.* Another practice that encourages students to integrate facts and principles of a domain is explanation, both to oneself and to others (Chi, Bassok, Lewis, Reimann, & Glaser, 1989). Explaining a concept supports engagement from text because it requires students to become reflective about incoming information (Brown, 1997; Guthrie et al., 1996; Menke & Pressley, 1994). Explanation can be facilitated through writing, discourse journaling, thinking aloud, or discussion with peers and others (Brown & Campione, 1998; Chi et al, 1989; Scardamalia et al., 1994).

A large body of evidence indicates that self-explanations increase conceptual learning from text and transfer propensity (Chan, Burtis, Scardamalia, & Bereiter, 1992; King & Rosenshine, 1993; Kucan & Beck, 1997; Wittrock, 1990). In her work on self-explanations, Chi and her colleagues (1994) found that when students were asked to explain text information, their comprehension of text improved. Specifically, self-explainers answered more complex questions, induced more correct inferences about the reading, made more elaborate mental models, and reached conceptually higher levels of knowledge than did non-explainers. Although explainers generated some incorrect

inferences and explanations, they tended to self-repair inconsistencies along the way. Unlike non-explainers, explainers did not refer to the text to answer synthesis and inference-based questions because they knew the answers were not there. Non-explainers sought answers in the text for such high-level questions 35% of the time.

Another study examined the effects of explanation on knowledge acquisition (King, Staffieri, & Adelgais, 1998). In this investigation, students were assigned to one of three groups: explanation only, inquiry plus explanation, and sequenced inquiry plus explanation. When students received training in asking each other thought-provoking questions and explaining concepts to one another, students increased their conceptual understandings as assessed by measures of knowledge integration and retention.

Simply asking the question, “why” often leads students to discern facts from concepts and increase elaboration and integration of information from reading (Menke & Pressley, 1994). Called elaborative interrogation, this questioning strategy requires students to explain why ideas presented in text may be true. In a study of sixth- and seventh-grade students’ recall of knowledge, students performed significantly better in an elaborative interrogation condition when compared to a condition in which children were simply asked to read for understanding (Woloshyn, Paivio, & Pressley, 1994).

Elaborative interrogation supported short- and long-term knowledge growth, even when incoming information was inconsistent with a student's prior knowledge.

In summary, the first quality of conceptual press involves creating opportunities for students to traverse between the facts and the principles of a conceptual domain. Instructional practices can support the integration of facts and principles of a domain through concept mapping, explanation, or elaborative interrogation. These supports for

information integration have been shown to increase cognitive and motivational aspects of engagement.

*Reorganizing textual information into different forms.* A second characteristic of conceptual press centers on having students reorganize incoming textual information into different forms. There is evidence that when students create new representations of available information, they gain more conceptual understandings of the domain (Brown, 1997; Novak, 1998). Instructional practices that support the reorganization of incoming information may include concept mapping (Novak, 1998); model building (Brown, 1997); and drawing (Chi et al., 1994; Scardamalia & Bereiter, 1994; Van Meter, 2001). Teachers utilizing these practices may ask students to (a) write in a journal, (b) explain information to themselves and others, (c) summarize information, or (d) draw diagrams, illustrations, concept maps, or charts during or after reading. These types of reorganizing activities require students to rely on the principles of the domain when constructing knowledge connections and, thus, help students gain conceptual knowledge, rather than superficial factual knowledge. Evidence regarding concept mapping and explanation was discussed previously; therefore, this section focuses on the research pertaining to drawing both during and after reading, and model building related to reading (Blumenfeld et al., 1991; Blumenfeld & Meece, 1988; Brown, 1997; Hewitt & Scardamalia, 1998; Turner et al., 1995).

*Drawing supports information reorganization.* Generating illustrations both during and after reading text is one reorganization activity that can be used to increase conceptual learning from text (Alesandrini, 1981) and increase student engagement (Van Meter, 2001). Through drawing, readers can induce and generate a new and coherent

representation of text. Snowman and Cunningham (1975) tested the hypothesis that drawing improves learning from text because it directs students' attention to specific concepts in the text passage. In this study, students read about a fictional tribe and were instructed to construct drawings either during or after reading, but before testing.

Significant recall differences favoring the drawing during reading led Snowman and Cunningham to conclude that drawing helped to facilitate the storage of text information.

In another study, students were asked to draw a representation of how air pumps work after reading a passage about air pumps (Hall, Bailey, & Tillman, 1997). This study compared three conditions. In one group, students were simply given the textual passage about air pumps. In another group, students were given the text passage, accompanied by a series of pictures depicting how an air pump works. In the third condition, students were asked to generate their own illustration after reading the text. Results indicated that students who generated illustrations scored significantly higher on a knowledge test about air pumps.

In another study, when students were supported in drawing after reading, not only did they learn more conceptual information, they also spent more time on the task, engaged in significantly more self-monitoring activities, and engaged more in learning the relations among concepts and facts (Van Meter, 2001). Fifth- and sixth-grade students were grouped into four conditions: (a) read only; (b) read and draw; (c) read, draw, and inspect; and (d) read, draw, inspect, and receive feedback during inspection. Students who received external supports after drawing made significantly more accurate knowledge expressions with regard to structures, functions, relations, and systems of the domain. Furthermore, students in this condition engaged in significantly more self-

monitoring activities; students detected errors in their illustrations and spent time fixing errors. Lastly, students spent significantly more time engaged in understanding the relations among the facts and concepts presented in the text.

*Constructing artifacts also supports information reorganization.* Many studies have shown that the creation of artifacts supports conceptual learning from text (Blumenfeld et al., 1991; Brown, 1997) and engagement with text (Turner et al., 1995). For example, in the CSILE project, students used an on-line environment to create, transform, and store electronic artifacts (Hewitt & Scardamalia, 1998). The environment was accessible to all students, and thus, one student's artifact served as the source of another student's artifact. Moreover, the interface for searching was a graphical knowledge map wherein students continually added information to create an ever-expanding source of information. In another study of information reorganization, Oshima and colleagues (1996) found that students who frequently reorganized incoming textual information into computerized graphical maps learned more conceptual knowledge than students who worked in the textual mode only.

In another study, learners designed an artifact after learning information on a sub-theme of life sciences (Brown, 1997). Students designed an imaginary animal to fit a specific habitat, and later they described how their imaginary animal might adapt to a new habitat. The results indicated that this activity helped students produce more coherent linkages among disciplinary content. Also, students reported being more engaged in learning the material. In sum, the second important quality of conceptual press involves creating opportunities for students to reorganize their representation of information either through drawing or creating artifacts. When teachers use these practice

of promoting information reorganization, students engage more in reading tasks and learn more conceptual information.

*The principle of moderate challenge.* A third quality of conceptual press focuses on supporting students in pursuing moderately challenging reading tasks. Many researchers point to the appropriate use of moderate challenge to spur engagement in learning (e.g., Csikszentmihalyi, 1990; Harter, 1981; Lepper & Hodell, 1989; Turner & Meyer, 2004; White, 1959). For example, Vygotsky (1978) claimed "the only 'good learning' is that which is in advance of development" (p. 89). Csikszentmihalyi's (1975) theory of emergent motivation explains that optimal challenge occurs when students' perceived capacities and level of instructional challenge are in alignment. When challenges are slightly ahead of a student's skills, a tension is created that stimulates concentration and effort (Csikszentmihalyi, Rathunde, & Whalen, 1993). Thus, a challenge is a function of prior knowledge and competence, as well as task difficulty. For example, when students of high competence and prior knowledge are confronted with a difficult task or text, they likely will experience optimal challenge. However, when students of low competence and prior knowledge face a difficult task, likely they will report frustration (Brophy, 1999; Csikszentmihalyi, 1975). Optimally, challenging activities are those that are at a student's intermediate level of difficulty. That is, they are neither too easy nor too hard.

Challenging reading tasks are often considered beneficial to students' cognitive and affective facilities (Csikszentmihalyi et al., 1993; Turner et al., 1998). When trying to meet challenges, students have reported clarity of purpose with strong concentration, alertness, and attention (Csikszentmihalyi & Rathunde, 1993; Turner et al., 1998).

Affectively, students have described feelings of intrinsic motivation, such as losing track of time and a feeling of being one with the activity (Csikszentmihalyi & Rathunde, 1993; Turner et al., 1995). Unfortunately, however, motivation researchers lament that even though the benefits of challenge are well established; many teachers continue to attenuate risk and challenge in the classroom (Csikszentmihalyi, 1990; Doyle, 1983; Stipek, 1996). For example, Miller and Meece (1997) reported that whereas students professed a preference for moderately challenging literacy tasks, such as writing over multiple days, only 3% of their 800 reading and writing tasks offered such challenge.

Clifford's (1991) notion of risk-taking aligns with instructional practices that support challenge. According to Clifford (1991), taking academic risks involves students electing to tolerate error and work on challenging tasks. Challenge and academic risk-taking play an important role in learning for many reasons. First, challenging tasks provide students with information about their progress. When students can meet increasingly difficult goals, they see concrete evidence of their growth. This evidence, in turn, increases their perceptions of competence and self-efficacy (Bandura, 1982; 1997; Schunk & Pajares, 2002). Second, challenging texts allow students the opportunity to learn from their mistakes. Research indicates that when given the freedom to explore without the risk of immediate evaluation, students take on risks, set higher goals, develop sophisticated strategies, and persist longer in learning activities (Clifford, 1988).

Miller and Meece (1999) studied third graders' reaction to and preference for challenging reading tasks. During a year-long observation/interview study with 24 students, the researchers identified literacy tasks as high or low challenge. The categorizations were based on (a) the duration of the task over a period of days or weeks;

(b) the number of collaborative events; and (c) the writing of extended prose as opposed to simple question-answer or fill-in the blank assignments. Results indicated that students who were frequently exposed to high challenge tasks reported positive affect, such as pride, increased effort, and desire to work hard. In contrast, students who were minimally exposed to challenging instruction reported low competence beliefs when faced with a challenging task. Interestingly, both high and low achievers, reported negative views of tasks that were too easy. These students did not report feeling pride or satisfaction in their work. For example one low achiever said, "I don't like the thinking that went into it." They felt bored and were aware that effort was not necessary. One student remarked, "If it doesn't make sense, you just go on to the next one."

Importantly, some studies have shown that elementary students feel disinclined to embrace challenge or they express a negative view of difficulty (Clifford, 1988; Turner & Cox, 1995; Turner et al., 1995). For example, in an important study of elementary children, Clifford found that students consistently chose test items that were at least one grade level below their own achievement level. Students in this study also reported only slight preferences for difficulty and negative concerns about potential error. Indeed their reports were consistent with their actual choices with regard to challenging tasks.

Therefore, teachers who use moderate challenge as an instructional strategy should try to encourage the positive valence of challenge that is described by motivation theorists (Clifford, 1991; Csikszentmihalyi, 1997; Turner & Meyer, 2004). Specifically, these teachers will fully divulge the satisfaction of learning something new, which is not easily attainable. In that regard, they will support persistence in completing reading tasks; they will consider student errors as constructive, and they will adjust instruction to

support students' press for understanding (Cox & Guthrie, 2002; Middleton & Midgley, 2002; Turner et al., 2002). In addition, the instructional emphasis is centered on supporting students to take academic risks and be effortful in the face of difficulty (Clifford, 1991). Teachers who use moderate challenge as a motivating practice will facilitate and scaffold reading tasks (see Guthrie, Wigfield, & Perencevich, 2004b; Vygotsky, 1978). Thus, the third important quality of conceptual press involves creating opportunities for students to persist during challenging reading events. When teachers use practice promoting persistence in the face of challenge, students will engage more in reading tasks and learn more conceptual information from texts.

In review, there are three defining qualities of conceptual press (see also Cox & Guthrie, 2002). When teachers provide support for students to integrate facts and principles of a domain, reorganize their representations of information, and persist during challenging reading activities, they are providing conceptual press. Based on the empirical evidence provided, I hypothesized that students' perceptions of conceptual press will significantly increase their engaged reading because of the cognitive and motivational processes it supports.

*Measuring conceptual press.* Relatively few measures exist that measure specific motivating practices targeted to increase engaged reading and conceptual learning from text. In this dissertation study, it was important to obtain students' perceptions of their teachers' practices in order to interpret how they affect students' self-processes (i.e., reading engagement) and conceptual learning from a science text. Existing measures of motivating instruction have relied on teacher report (Guthrie et al., 1996) or ratings by outside observers (Dolezal, Welsh, Pressley, & Vincent, 2003; Pressley, et al., 1996;

Turner et al., 1998), rather than student perceptions. These measures may not have fully captured students' interpretations of practice in a given context and domain. Actually, a measure that is widely used in studies of student motivation that does assess student perceptions is the Classroom Goal Orientation scale (Midgley et al., 1998; Turner et al., 2002). However, this measure captures very broad ideas about the classroom climate, void of content and context. In many studies using this measure, researchers found that teacher and student ratings of the same classroom tended to be quite disparate (Ryan, Gheen, & Midgley, 1998). A measure of students' perceptions in a specific context about a specific content domain provides a more ecologically valid method of understanding motivating instruction.

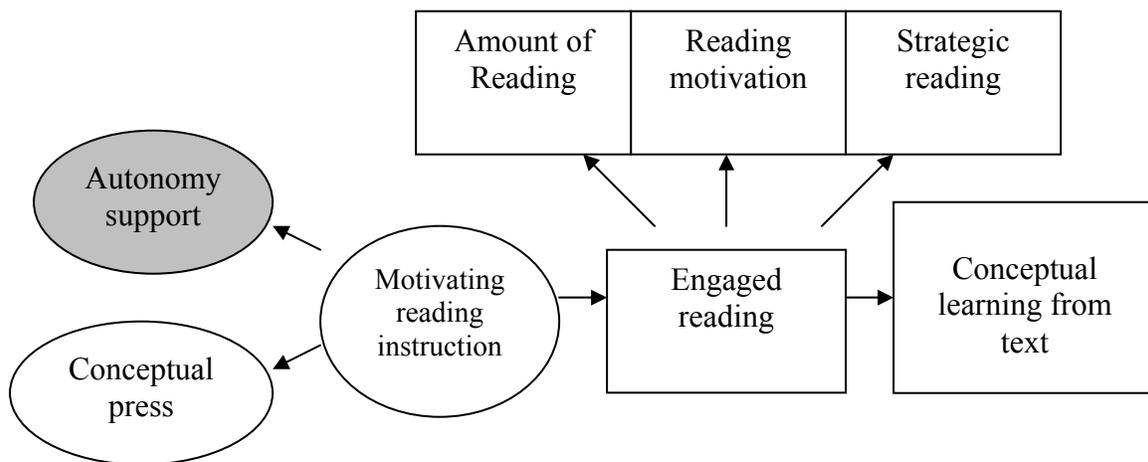
An important reason to create a measure of conceptual press was to fulfill the need for specific practice with regard to specific content and contexts. For example, the emphasis on principles in a context of learning information from a science text has not been assessed formally. Chi and her colleagues (1994) and Guthrie and Scaffidi (2004) developed measures for identifying levels of conceptual learning from text after reading a passage. However, instructional practices that support students in developing these understandings of examples in a domain and principles of a domain have not been assessed. Likewise, studies have examined the effects of information reorganization on conceptual learning from text; however, no formal assessment tool exists to measure the extent to which teachers use these instructional practices.

With regard to moderate challenge, there exist measures to assess students' preferences for difficulty, such as Clifford's Preference for Difficulty Scale (1988) and Wigfield and Guthrie's (1997) Motivation for Reading Questionnaire (MRQ). However,

these measures focus on individual differences, rather than qualities of the instruction that foster challenge. The Experience Sampling Method [ESM] (Csikszentmihalyi & Rathunde, 1993) measures students' perception of the instruction with regard to the match between student perceived skills and the challenges offered. The measure has been used to identify individual activities and lessons in which students report an occurrence of a match between skills and challenges (Csikszentmihalyi & Rathunde, 1993; Cox, Turner, & Meyer, 1996; Turner et al., 1998). However, there are limitations in using the ESM. One weakness is that the method is extremely time-consuming and does not lend itself to generalization of results. Also, the ESM uses one item to assess perceived level of challenges and skills (e.g., How challenging was this lesson?) In a study using the ESM, Turner and her colleagues (1995) found that fifth-grade students had quite disparate definitions of challenge and used the challenge item quite differently.

In summary, a new measure of conceptual press was developed to assess the conceptual emphasis of instruction according to students' perceptions in the context of reading a science text. Since very few measures of this kind exist, this measure was necessary. Measuring very specific aspects of instruction at a domain specific level provided a more complete portrait of practices that support reading engagement and conceptual learning from text. The items on this measure were in part based on fifth-grade student interviews and observations, and have been used in two previously unpublished pilot studies (Cox & Guthrie, 2000; 2001b).

In the following section, I define and provide empirical support for the construct of autonomy support, which is another motivating practice hypothesized to increase reading engagement.



*Figure G.* Indirect effects model of motivating reading instruction, engaged reading and conceptual learning from text: The role of autonomy support

*Theoretical Foundation for Autonomy Support*

In line with the idea that self and context dually influence self-determined behaviors (see Skinner & Belmont, 1993), it is important to realign authority structures in instruction to support student autonomy (Ryan & Deci, 2000; Stefanou et al., 2004). Most theorists (e.g., deCharms, 1968; 1976; Deci & Ryan, 1985) refer to autonomy as "the process of utilizing one's will" (Deci, 1980, p. 26). Autonomy has been long recognized as an essential ingredient for fostering self-determined behaviors (deCharms, 1968; 1976; Grolnick, Ryan, & Deci, 1991; Ryan & Stiller, 1991). In fact, Heckhausen & Schulz (1999) describe the importance of personal control in all aspects of development

All scientific reasoning and research on the phylogenetic origin of higher-order mental functions, such as self-concept, language, and social organization...largely hinges on the organism's and community's ability to control the environment (p. 605).

Deci and Ryan (1994) posited that students who feel fully autonomous will be engaged in the learning process. Supporting autonomy refers to the idea “that an individual in a position of authority (e.g., a teacher) takes the other’s perspective (e.g., a student’s), acknowledges the other’s feelings, and provides the other with pertinent information and opportunities for choice, while minimizing the use of pressures and demands” (Black & Deci, 2000, p.742).

One of the first theories about autonomy support was espoused by deCharms (1968). He asserted that perceived control could be explained in terms of individuals perceiving themselves to be either origins or pawns. He defined an origin as "a person who perceives his or her behavior as determined by his own choosing," and a pawn as "a person who perceives his or her behavior as determined by external forces beyond his control" (p. 273-274). According to deCharms (1968; 1976), origins engage in setting realistic goals, determining appropriate actions that accomplish goals, and assessing progress toward the goals. In contrast, pawns feel controlled by external events in the environment, and thus, lack volitional strategies and behaviors.

Deci and Ryan (1985) extended the discussion of origins and pawns from that of polar variables on a dichotomy to a continuum ranging from those who perceive themselves to engage in autonomous, self-determined actions to those who perceive their actions to be externally controlled. Based on extensive interviews, categories emerged describing reasons why students endorsed engagement in achievement behaviors (Ryan & Connell, 1989). The categories included external regulation, introjected regulation, identified regulation, and internal regulation (intrinsic motivation). The gradations students’ experience form a theory of internalization, which states that the more

internally valued and regulated a behavior is, the more it is experienced as autonomous (Deci & Ryan, 1985; Ryan & Deci, 2000).

Intrinsically motivated behaviors are performed out of interest and enjoyment of an activity for its own sake. No external controls or separable consequences are associated with intrinsic motivation. According to Deci and Ryan (1985), this represents the most autonomous and self-determined behaviors because it is completely volitional and emanates from the person's sense of self. However, this is not to say that extrinsically controlled behaviors cannot become self-determined. Through the process of internalization, students can come to transform externally regulated behaviors into internally regulated behaviors. For example, students can come to value socially sanctioned activities and internalize the reasons for engaging in them.

According to motivation theorists, intrinsic motivation will suffer when individuals cannot exercise self-determination (Deci, Vallerand, Pelletier, & Ryan, 1991). In a summary of research, Deci and Ryan (1987) found three instructional practices that negatively affected self-determination. First, providing rewards for simply completing tasks decreased self-determination. Second, threats or deadlines curtailed self-determination. Third, evaluation and surveillance showed negative effects on student self-determination. With regard to instructional practices that support self-determination, Deci and Ryan (1987) concluded that choice and positive feedback regarding competence increased a student's perception of control. Furthermore, they posited that perception of control fosters engagement, responsibility, and persistence.

The goal then, according to Deci and Ryan (1994), is to support students in becoming self-determined learners. Ryan and Stiller (1991) asserted that "the more we try

to control and pressure learning from without, the more we obstruct the tendencies of students to be actively involved and to participate in their own education" (p. 117). In the next section, I describe some empirical studies that link autonomy supportive practices with student engagement.

*Authoritarian verses supportive control.* Classrooms vary widely in the ways they support student autonomy (deCharms, 1976; Ryan & Grolnick, 1986; Stefanou et al., 2004). Early studies investigated the influence of adult control patterns on children's behaviors. In their classic study, Lewin, Lippitt, and White (1939) found that different leadership styles influenced student motivation, participation, and completion of work. Ten-year old boys were appointed to one of three groups employing different leadership styles: authoritarian, democratic, and permissive. Overall, the results indicated that both the authoritarian and democratic leadership styles led to increased productivity compared to the permissive environment. However, significant differences were found in the dynamics of each group. Whereas the boys in the authoritarian leadership group felt tense and anxious, the boys under the democratic leadership felt a sense of control over their products and sensed a cooperative atmosphere. The supportive control under the democratic leadership created the tone for students to be persistent and productive, even in the absence of the leader.

Since the Lewin et al. (1939) study, other researchers have examined the differences between authoritarian and democratic environments (e.g., Boggiano & Katz, 1991; Deci, Schwartz, Sheinman, & Ryan, 1981; Grolnick & Ryan, 1987; Skinner & Belmont, 1993; Weinert & Helmke, 1995). A considerable body of research shows strong evidence that controlling environments contributes to low achievement, anxiety,

preference for easy work, and dependence on others for evaluation (Boggiano & Katz, 1991). On the other hand, significant relations have been found between autonomy support and positive outcomes. These positive outcomes include (a) intrinsic motivation (Zuckerman, Porac, Lathin, Smith, & Deci, 1978), (b) preference for optimally difficult work (Harter, 1978; Pittman, Emery, & Boggiano, 1982; Wigfield et al., 2004), (c) striving for conceptual understanding (Benware & Deci, 1984; Flink, Boggiano, & Barrett, 1990; Grolnick & Ryan, 1987), (d) a sense of enjoyment and vitality (Nix, Ryan, Manly, & Deci, 1999) and (e) perceived competence (Cordova & Lepper, 1996).

*What exactly do autonomy supportive teachers do?* Reeve and his colleagues (1999) categorized teachers as high or low in autonomy support and made several interesting findings across two studies. In the first study, pre-service teachers were given a self-report measure to identify how autonomy supportive or controlling the teachers perceived themselves to be. Next, they were given a prompt to teach individual students a puzzle task "in any way they saw fit" (p. 541). Over a ten-minute session, a teacher's statements were coded into 11 categories, including (1) directives, (2) should/must statements, (3) controlling questions, (4) questions asking about student wants, (5) responding to student generated questions, (6) praises, (7) encouragements, (8) hints given, (9) solutions given, (10) personal statements, and (11) perspective taking. Also, videotaped sessions were coded for the number of seconds the teacher talked, listened, and held instructional materials. Based on a coding of utterances and a factor analysis, teachers were categorized as high or low in autonomy support.

Teachers categorized as high in autonomy support listened to students more often and held materials less often than those teachers identified as low in autonomy support.

With regard to discourse, autonomy supportive teachers were more likely to ask about student wants, respond to student-generated questions, and volunteer perspective taking statements. Autonomy supportive teachers were less likely to give solutions or use directives. Furthermore, Reeve and his colleagues (1999) found differences in how high and low autonomy supportive teachers attempted to motivate disengaged students. Compared with their controlling counterparts, autonomy supportive teachers described specific attempts to support intrinsic motivation, such as creating a student-centered atmosphere, encouraging student initiative, nurturing competence, and using non-controlling communication. Additionally, these teachers attempted to promote internalization by providing rationales and promoting the valuing of the task. Finally, misconceptions have long existed that autonomy support endorses a passive approach to teaching (e.g., allowing students to work in their own ways). However, Reeve and his colleagues showed that in fact, autonomy supportive teachers were more enthusiastic and more active in promoting students' initiatives.

Other studies have found similar practice to support autonomy (see also Guthrie, et al., 2004b; Stefanou et al., 2004). For example, Assor, Kaplan and Roth (2002) reported similar findings regarding the saliency of teacher supports for autonomy. They distinguished between three types of autonomy support: (a) fostering relevance by articulating the role of the learning activity in relation to the students' personal goals, (b) allowing students to express dissatisfaction about tasks such that the teacher could rethink the task, and (c) providing students with choices consistent with their personal goals and interests. Assor and his colleagues questioned students and found that the most important predictors of autonomy were fostering relevance and suppressing criticism.

In short, there are several motivating practices that promote student autonomy. In the following section, I discuss empirical studies that connect these types of practices with reading engagement.

*Empirical links between autonomy support and student engagement.* Autonomy supportive practice influences student engagement and achievement (Deci, Nezdek, & Sheinman, 1981; Miserandino, 1996; Weinert & Helmke, 1995). In a longitudinal study, Weinert and Helmke tested the relation between different types of teacher control and academic achievement throughout the elementary school years. They found a positive relation between teacher-supportive control and academic achievement. Furthermore, in this study, student attitudes toward learning and their percentage of on-task behaviors were significantly higher in the teacher supportive condition. The patterns for authoritarian teacher control were the exact opposite—a high percentage of passive learning, low levels of achievement, and negative attitudes toward learning.

In one study, autonomy supportive practices increased students' perceived competence and mastery motivation. In a study, 889 upper elementary students in 36 classrooms completed self-report measures of intrinsic motivation (e.g., curiosity, preference for challenge, and independent mastery), perception of the classroom context along a continuum of controlling to autonomy supportive (deCharms, 1976), and a measure of self-esteem (Deci & Ryan, 1987). Also, teachers completed a measure to assess their style with regard to autonomy or control. The results indicated that there was a strong correlation between autonomy supportive practice and intrinsic motivation among students. Specifically, autonomy supportive practices were significantly correlated with students' preference for challenge ( $r = .43, p < .01$ ) and curiosity ( $r = .37, p < .01$ ).

What was also interesting about this study was that the influence of autonomy supportive practice on motivational processes was relatively immediate and remained stable over the school year.

In another study, Miserandino (1996) examined the engagement practices of 77 above-average elementary school students. She found that students who perceived themselves as competent and autonomous were more curious, persistent and involved. They reported enjoying schoolwork more than students who reported low competence beliefs and low autonomy. For example, in a multiple regression procedure, perceived autonomy accounted for 30% of the variance in curiosity and perceived competence accounted for 37% of the variance in curiosity. In this study, perceived competence and perceived autonomy changed over time and predicted changes in grades over the school year. This result showed the effect of the social context in the model-- students who have their needs for competence and autonomy met will increase their engagement in school activities. What is interesting about this study is that even though students were all above average, some still experienced uncertainty in their competence and felt controlled in school, which was at odds with their achievement scores.

In a summary of research, Deci (1995) reported that there are six essential teacher practices to promote autonomy in the classroom (1) promoting a student-centered atmosphere, (2) encouraging initiative, (3) providing rationales, (4) nurturing competence, (5) using non-controlling communication, and (6) promoting a valuing of the task.

*Defining autonomy support in this study.* In a substantial review of the literature on constructs of control, Skinner (1996) stressed that it is important to differentiate perceived autonomy support from an internal locus of control (e.g., luck or effort). In fact, Skinner argued that the constructs related to autonomy are conceptually distinct from the constructs related to control. She stated that "control refers to there being a contingency between one's behavior and the outcomes one receives, whereas self-determination refers to the experience of freedom in initiating one's behavior" (p. 557). Reeve (1998) concurred and proposed that "autonomy support revolves around the teacher's effort to identify and support students' interests and volitional internalization of the school's values and agenda" (p. 547).

In this dissertation, my definition of autonomy support implies that the student is sharing in the responsibility of the decision-making in the classroom milieu, *not* that the student is the sole decision-maker (see also Garcia & Pintrich, 1996). Additionally, autonomy support is not defined herein as permissiveness or lawless confusion. Eccles and her colleagues (1991) stressed that the appropriate amount of control and autonomy should be exercised as a function of a student's developmental level. Although the Eccles et al. (1991) study focused on early adolescence, the cautions are germane for any developmental group. It is certainly possible to set limits on children's behaviors in an autonomy supportive manner (Eccles et al., 1991; Guthrie et al., 2004b; Koestner, Ryan Bernieri, & Holt, 1984; Stefanou et al., 2004). It is the structure and guidance that helps foster autonomy. McCaslin and Good (1996) coined the term *co-regulation* to express the interdependent relation between the student and teacher in making decisions and choices

in the classroom context. This assumption fits with the definition of autonomy support in this study.

Based on the extant literature, in this investigation, autonomy support refers to students' perception of control over the goals, contents, strategies, standards for success, and social interaction patterns in their learning environment. Central instructional components of autonomy support involve choice and ability to negotiate assignments, such as level of difficulty (Deci et al., 1981), degree of personal meaningfulness (Turner et al., 1995), and allowing students to form, execute, and monitor self-conceived goals (Blumenfeld, 1992b; Blumenfeld & Meece, 1988). In the following sections, I will discuss the existing literature with regard to three qualities of autonomy support (a) choice, (b) ownership, and (c) creation of personal goals for reading.

*Choice: Breadth and academic significance.* Autonomy support includes breadth of choice and academic significance of choice. First, teachers can provide a scope of alternatives about different aspects of learning, such as strategy selection, evaluation, time on task, response type, organization of work, or topics to study. Additionally, autonomy support includes academic significance of choice, which refers to the provision of control over the central and relevant academic tasks and evaluation methods. Although choice is widely recommended by motivational theorists (Brophy, 1999; Deci & Ryan, 1994; Stipek, 1996), relatively few studies have actually examined the role of choice in the context of reading engagement and conceptual learning from text. Moreover, the studies have mostly been implemented with college students, and in domains other than reading, such as mathematics.

One experiment examined the effects of choice on students' intrinsic motivation in computer activities designed to teach arithmetic skills (Cordova & Lepper, 1996). Seventy-two elementary school students participated in the study and were assigned to one of five conditions. In the control condition, students engaged in computer-based learning games with no embellishments or choices. The experimental students were then asked to use computer games with varying degrees of fantasy embellishments. Half of the students were given fantasies in the generic form and the other half were given fantasies plus a personalized embellishment, based on each student's given background information. Also within each fantasy group, half of the students were given choices about fantasies, such as naming a spaceship and choosing which type of spaceship to ride in. Students in the personalized and choice condition significantly enjoyed the activity more than students in the other conditions. Moreover, they expressed a willingness to stay after class to play computer games. In the choice conditions, students scored better on a post-test, solved more problems, and reported a preference for a more difficult game in the future. Interestingly, Cordova and Lepper only allowed students to have choices over the trivial aspects of the learning event and still showed significant benefits for learning.

In an observational study of first-grade reading activities, Turner (1995) found that when teachers provided activities in which children were afforded a certain degree of freedom and responsibility (e.g., they chose which story to read and whether to write or draw), student intrinsic motivation was relatively high. In contrast, intrinsic motivation declined when teachers provided little choice, challenge, or opportunity to exercise alternatives in learning activities. Similar effects were shown in follow-up studies (Turner

et al., 1995, 1998). In another study, Metheny and Edwards (1994) gave choices and responsibility to students as they worked in independent learning centers. Students were expected to evaluate their progress and direct their activities based on self-appraisal. These conditions increased students' perceived control and significantly increased student achievement.

In the domain of reading, Schraw and his colleagues (1998) studied the role of choice in reading engagement with college students. In two experiments, college students were separated into two groups. One group was offered choice over which book to read and the other group was in a denied choice condition wherein students were aware that others could choose and they could not choose the text. In two experiments, the researchers found that students in the choice condition reported more interest in and positive attitudes about the reading task. However, choice did not significantly influence cognitive engagement in reading (such as, strategy use, comprehension test, or critical responses). A large limitation of this study, however, was that students likely perceived the choice to be insignificant. The experiment was required as part of an educational psychology course, but offered limited stakes for completing the post-test measures. In this investigation, my interest lies in the cumulative effects of choice over a longer period of time, not simply one exercise in choosing a text. The types of choice and autonomy support being discussed herein involve extended choices that are academically significant, which may empower students to become self-determining. In this dissertation study, I was interested in academically significant choices that were tied with curricular events and content. Along with breadth of choice and academic significance of choice, depth of control is an important constituent of autonomy support.

*Ownership.* The second quality of autonomy support in this study is students' ownership over reading activities. Ownership refers to the process of according students' control in the form of honoring their voices and allowing them to direct movement of curricular decisions (see also Stefanou et al., 2004). In her work on communities of learners, Brown (1997) explained "Students and teachers each have ownership of certain forms of expertise but no one has it all" (p. 12). This quality of autonomy support renders control to students such that they can perceive themselves to be experts, or owners, of their own knowledge, rather than the teacher or a book being the sole distributor of relevant knowledge.

Reading researchers have discussed depth of control with regard to the structure of the discourse surrounding a text reading. For example, an IRE (initiate-respond-evaluate) structure of discourse has been compared with a more responsive type of discourse that allows for student ownership over text interpretations. Research indicates that IRE structures tend to focus on literal and text-based questions as a means of forming impressions regarding students' comprehension (Cazden, 1986; Mehan, 1985). This implies that there is only one accurate interpretation of the text--that which is the author's intended meaning. Because of the uni-directionality presupposed by IRE structures, students often come to view the teacher as the sole interpretive authority, rather than relying on their own ideas to construct meaning.

On the other hand, Reader Response Theory is based on the idea that meaning is a function of one's collective experiences and that meaning resides in the transaction that occurs between the reader and the text (Rosenblatt, 1978). Fish (1980) contended that as 'interpretive communities' interact, previously undiscovered interpretations are derived

from the coalescence of divergent views about text. The teacher's role, then, becomes one of facilitator and coach rather than authority, inquisitor, and evaluator.

Oldfather (1993) conducted an investigation of fifth- and sixth-grade students' perceptions of purposes for involvement in literacy activities. Like the findings of deCharms (1968), Deci (1995), and Ames (1992b), she found that intrinsic motivation was significantly related to student self-expression, which she called the 'honored voice'. When student voices were honored, they knew that their opinions and personal views on topics of study and interpretations of text were valued. Oldfather (1993) found that students who felt that their voices were honored were also the students who experienced much more ownership in their literacy activities.

When students perceive ownership over their goals, they report high intrinsic motivation and reading engagement (Au, 1998; Morrow, Pressley, Smith, & Smith, 1997; Turner & Cox, 1995). For example, in a study of literacy instruction, Turner and Cox found that when fifth-grade students led discussions, shared ideas, initiated topics, and took turns deciding when to shift the discussion, they reported a high value for the activity and an increased interest in taking responsibility for their personal literacy goals. In addition, Au (1997) created a curriculum intended to foster ownership of literacy. The curriculum contained an emphasis on reading comprehension, writing process, language and vocabulary, word reading strategies, and voluntary reading. She reported that these themes were central to the year-long program in which students' ownership and skill in writing increased significantly. Finally, Morrow showed, in controlled experimental studies that when students were supported to take ownership of their reading, reading

comprehension and amount and breadth of reading, as indicated by measures of print exposure, increased significantly.

Ownership is an essential quality of autonomy support because it helps students to develop possession of their interpretations of text (Tharp & Gallimore, 1993). If children become reliant on teachers to interpret texts for them, and if the learning environment restricts children to respond only to teacher-initiated, literal questions about text, then students' opportunities to craft their own personal interpretations about text become severely limited. Therefore, an important characteristic of autonomy support in this study is students' ownership over their reading and reading processes.

*Creating personal goals for learning.* The last quality of autonomy support involves teachers' encouragement for students to create personal goals for learning. As Dewey (1913) suggested that "teaching may be compared to selling commodities. No one can sell unless someone buys" (p. 35). In order to help students *buy* into learning, teachers must support them in finding goals that align with their personal interests and curiosities.

Specifically, this quality of autonomy support refers to the degree to which instruction is relevant to the students' knowledge and individual interests (Au, 1997; Linn & Muilenburg, 1996); the degree to which students can manipulate aspects of instruction to fit their own student-centered goals (Stefanou et al. 2004), and the degree to which instruction allows students to initiate their own inquiry in learning (Perencevich, 2004). Research indicates that when students shape tasks and goals to represent what they value, and shape those interests which hold personal significance, then they will be more engaged with the content (Lambert & McCombs, 1998). As Dewey described "to set up a

problem that does not grow out of an actual personal situation is to start on a course of dead work, nonetheless dead because the work is busy work” (original essay reprinted in McDermott, 1973, pp. 229-230).

Classroom texts and tasks must give opportunities for students to construct personal meaning in order for them to engage deeply in learning (McCombs, 1997). When teachers assist in helping students create personal goals for learning, the learning becomes more relevant and useful. When students regard a task as relevant, they will engage, persist, and eventually reach deeper levels of conceptual learning. For example, in an experimental study, Benware and Deci (1984) evaluated the effect of personal goals on conceptual learning from text. There were two conditions. In the first condition, students were asked to read the text in order to teach it to another student. In the second condition, students simply read a text with the purpose of taking a test on the material. Benware and Deci (1984) found that reading with an active orientation toward a personally significant goal led to greater conceptual knowledge gained from text.

In an aforementioned study regarding autonomy supportive practice using various computer tasks, students responded well to the personally meaningful learning context (Cordova & Lepper, 1996). In fact, the personalization and choice was the condition in which students reported high motivation and engagement. The researchers reported that when the fifth-grade students realized the context was individually personalized, "squeals of delight could actually be heard from many students" (p.727).

In a related line of inquiry, researchers reported that interest in a reading topic leads to the use of deep-level comprehension strategies (e.g., Alexander, 1998a; Anderson, 1993; Palincsar & Brown, 1984). In the motivation literature, interest

generally represents a reciprocal relation between an individual and the environment, such that an interest-related goal is compatible with a student's preferred values and desires (Deci & Ryan, 1985). "An interest is composed of value-related and feeling-related valences. The value-related valences refer to the assumption that any interest has the quality of personal significance. The feeling-related valences refer to positive experiential states while being engaged in an interest-based activity" (Krapp, 1999, p. 26).

In a study, Anderson and his colleagues (1988) reported that student interest in reading materials was an important determinant of comprehension. The recall of sentences and reading comprehension scores showed that personal value for text was thirty times more important than the readability index. Similarly, Schiefele (1991) conducted a study using text of varying degrees of individual interest as surveyed by fifth-grade students to assess the effects of recall. The results indicated that high-interest reading material was significantly related to deeper levels of comprehension.

In addition, research on interest indicates that interesting tasks and materials are highly correlated with effort and amount of time spent on a task (Renninger, Hidi & Krapp, 1992). Pressley and his colleagues (1996) also reported that teachers who are nominated as outstanding by their supervisors are frequently observed attempting to motivate learning by displaying books and reading books aloud in ways that emphasize their interest-value for students. In another intervention study, Paris, Yambor, and Packard (1998) found that an inquiry-guided exploration, in which students created personal goals, increased third, fourth, and fifth graders' problem-solving skills.

In summary, teachers who support student autonomy are creating conditions for students to feel in control of their learning. This, in turn, will lead to a heightened sense of responsibility for and active engagement with reading. It is well established that autonomy support heightens engagement and learning outcomes, but there is a paucity of research on these relations in the specific domains, such as reading and science. In this investigation, my definition of autonomy support refers to the degree to which the student perceives that he or she experiences choice, ownership, and personal meaningfulness in the science/language arts classroom. This is different from previous research that measured autonomy support based on the teachers' responses to very general hypothetical scenarios (Deci, Schwartz, Sheinman, & Ryan, 1981; Skinner & Belmont, 1993; Deci et al., 1992). It was my contention that student experiences of autonomy support in a domain specific milieu (rather than the teacher's report) would be closely linked to students' reading engagement processes and conceptual learning from text. Therefore, I created a measure of autonomy support based on domain-specific practices known to heighten students' perceptions of autonomy in the classroom.

#### *The Self-Process Model of Motivation*

Connell and Wellborn (1991) proposed a theoretical framework that includes three self system processes to be important to academic outcomes. They are relatedness, competence, and autonomy. According to the theory, students develop their perceptions of competence, autonomy, and relatedness on the basis of their interactions in a social context, such as the classroom. When these processes are fostered in the classroom context, engagement is likely to be manifested in affect, cognition, and behavior. Lastly, Connell and Wellborn's model suggests that affective, cognitive and behavioral

engagement in school influences academic outcomes, such as grades and skills. This theoretical model served as the framework for this investigation. In this study, the directional relations between motivating reading instruction (i.e., social context), engaged reading (i.e., self-process), and conceptual learning from text (i.e., academic outcome) were examined.

Some investigations empirically support the self-process model of motivation (Cox, Guthrie, & Hancock, 1999; Guay, Boivin, & Hodges, 1999; Skinner et al., 1998). For example, in an investigation of 200 elementary school children aged 9-12, the self-process model of motivation was empirically tested (Skinner et al., 1990). In this study, researchers were interested in two aspects of motivating instruction, teacher contingency and involvement. Contingency referred to whether the teacher provided clear and consistent expectations and feedback. Involvement referred to whether the teacher showed positive interest in knowing the children and considering their opinions when making decisions.

It was hypothesized that active engagement in learning would be a mediator between perceived control and actual cognitive outcomes. Skinner and her colleagues (1990) found that social context significantly correlated with student control beliefs (contingency,  $r = .25, p < .001$ ; involvement,  $r = .19, p < .001$ ) and with strategy beliefs (contingency, ns; involvement,  $r = .36, p < .001$ ). In order to conduct a path analysis, contingency and involvement were combined to form a composite representing social context. In the path analysis, social context significantly contributed to positive perceived control ( $\beta = .52, p < .001$ ) which, in turn, contributed directly to achievement scores

( $\beta = .17, p < .05$ ). Also, there was a significant path between engagement and achievement scores ( $\beta = .31, p < .001$ ).

Skinner and Belmont (1993) extended this study and added autonomy support along with teacher involvement and structure. Participants included 144 third-grade students and their 14 teachers. In this study, time-lagged path analysis showed that student perceptions of structure and involvement significantly predicted student engagement. Teachers' ability to structure the classroom predicted the behavioral constituents of engagement, and involvement predicted the affective constituent of engagement.

These results have also been found in the domain of reading (Maehr & Fyans, 1989). For example, in a study of Grade 10 students from 205 public schools, students rated their school in terms of its school culture with regard to accomplishment, power, recognition, affiliation, and mission (Maehr & Fyans, 1989). In this study, perceived school culture had an indirect influence on reading achievement, which was mediated through student motivation. The significant standardized path coefficients were school culture to motivation (.19) and student motivation to text comprehension (.43). The extent to which students identified a positive school culture increased their reading engagement through their motivational goals. Other studies have found indirect effects among engaged reading, motivating instruction and conceptual learning from text (Guthrie et al., 1998; Guthrie, Anderson et al., 1999; Guthrie, Wigfield, Barbosa et al., 2004).

### *The Current Study*

My dissertation study specified two sets of motivating practices; conceptual press and autonomy support. I hypothesized that these motivating practices would increase reading engagement, and in turn, reading engagement would increase conceptual learning from text. I also hypothesized that a theoretical model including reading engagement would better explain the relation between motivating reading instruction and conceptual learning from text than a model directly linking motivating reading instruction with conceptual learning from text. This is consistent with self-process model of motivation (see Connell & Wellborn, 1991; Guay & Vallerand, 1997; Skinner & Belmont, 1993; Skinner et al., 1990), which posits that students' self-processes play an intervening role between the instructional context and academic outcomes.

In the domain of reading, indirect effects of engagement have been studied. In one study (Guthrie et al., 1996), instruction, which included several motivating practices (e.g., CORI), had a significant path coefficient to strategic reading ( $\beta = .748$ ) and a significant indirect path to gaining new knowledge from text ( $\beta = .135$ ). Students' self-process, in this case, strategic reading, mediated the relation between motivating reading instruction and conceptual learning from text. In this dissertation, I expanded on this model by expanding the measurement of reading engagement to include not only the cognitive constituent of reading engagement (e.g., strategic reading), but also a behavioral constituent (e.g., amount and breadth of science reading) and an affective constituent (reading motivation). Further, I isolated and defined two specific motivating practices (e.g., conceptual press and autonomy support) to measure their associations with reading engagement.

The study of motivating reading instruction is important for several reasons. First, there have been very few empirical investigations focusing on how specific motivating practices influence both the cognitive, affective, and behavioral aspects of engagement (for exceptions, see Guthrie, Wigfield, Barbosa et al., 2004; Meece, 1991). There have been program interventions that have included conceptual press and autonomy support (e.g., CORI, CSILE); however, these motivating practices have not been studied in isolation in order to determine their relations with reading engagement. In this study, motivating reading instruction and reading engagement were measured at a domain specific level rather than a general level. I created a new student self-report measure to assess not simply students' perception and engagement during one specific task, but rather students' perceptions of their teacher's support in a reading/science domain in general.

Lastly, it was important to test the relations between reading engagement and conceptual learning from text. According to the self-process model of motivation (Skinner et al., 1998), when the social context nurtures individuals' needs, such as competence and autonomy, engagement processes will be fostered. It has been documented that these engagement processes, in turn, increase academic performance. It was my contention that the outcome of conceptual learning from text in science depends on self-processes, such as reading efficacy, intrinsic motivation for reading, cognitive strategy use, and behavioral intentions to read widely and often in a domain. Certainly, it is the reader who determines the relevancy of a text, decides which text topic arouses curiosity, and selects which difficulty level of text is appropriate. The reader also determines how well the task could be accomplished, given the reading strategies he or

she knows. Wide and frequent reading is also a result of self-processes. Thus, these affective, cognitive, and behavioral properties of the self come to coordinated action and manifest themselves as reading engagement. I described these affective, behavioral, and cognitive attributes as engaged reading throughout this review.

Research indicates that reading engagement processes are shaped partly by the classroom context in which students belong (Guthrie, Wigfield, Barbosa et al., 2004; Turner et al., 1998). To review, it is not motivating reading instruction in and of itself that brings about conceptual learning from text. Rather, it is how the instructional practices influence students' self-perceptions and behaviors to increase engagement. Therefore, in measuring engaged reading, self-report measures of affect and behavior are combined with actual performance indices of cognition and behavior to better reflect the construct.

Consistent with previous studies on motivating instruction, it was my contention that teachers could *press* students to conceptual understanding and support autonomy through their instruction and both are engaging practices. Specifically, when teachers provide students with support to (a) weave subject matter facts with guiding domain principles, (b) reorganize incoming information, and (c) persist in moderately challenging reading tasks, they are providing conceptual press. Furthermore, when teachers provide outlets for optimal choice and ownership and allow students to pursue activities that are personally defined and relevant, they are supporting autonomy. When students perceived instruction to embody conceptual press and support autonomy, I expected that they would become more engaged in reading. That is, students would report wide and frequent reading in the science domain; they would use cognitive reading strategies during a science reading task, such as summarizing and searching, and they would report high

intrinsic motivation and efficacy for reading. Second, I expected that reading engagement would in turn, be associated with conceptual learning from text. Lastly, consistent with the self-process model of motivation, I expected that motivating reading instruction would be significantly associated with engaged reading; and engaged reading, in turn, would be significantly associated with conceptual learning from text. Specifically, I hypothesized that an indirect model, including engaged reading, would better explain the relations between motivating reading instruction and conceptual learning from text than a direct effects model that does not include engaged reading.

*Review of definitions.* Motivating reading instruction is defined as students' perceptions of conceptual press and autonomy support. Conceptual press refers to students' perception of their teacher's support for integrating facts and principles of a domain, reorganizing incoming text information, and persisting during moderately challenging reading tasks. Autonomy support refers to students' perception of their teacher's provision of optimal choice, ownership, and personal relevancy in reading. In this study, the conceptual press and autonomy support were measured with a student self-report questionnaire.

Three constituents of engaged reading were included in this study: reading motivation, amount and breadth of science reading, and strategic reading. These constituents represent the affective, behavioral, and cognitive qualities of engagement. Reading motivation in this study refers to students' self-reports of their curiosity, involvement, preference for challenge, and efficacy in reading. Amount and breadth of science reading refers to wide and frequent reading in the domain of science. Strategic reading refers to students' deliberate use of approaches to understand text. In this study,

two specific, strategic reading processes were measured, searching and summarizing. Engaged reading was assessed using three measures (a) a self-report measure assessing four aspects of motivation for reading; (b) a self-report measure of amount and breadth of reading in the science domain; and (c) a performance assessment of students' strategic reading on a reading task.

Conceptual learning from text refers to the process of constructing new knowledge through interacting with text. Conceptual learning from text was measured with a reading performance assessment in the domain of science.

Prior knowledge was used as a control variable in this study because of its moderate to high correlations with conceptual learning from text (Alexander, Jetton, & Kulikowich, 1995). In this study, prior knowledge refers to a reader's pre-existing knowledge base, including topical knowledge of ponds and deserts, knowledge of paragraph writing, and knowledge in the domain of ecological science.

*Research hypotheses.* To review, three research hypotheses were addressed: (a) Engaged reading will be positively associated with conceptual learning from text, such that as engaged reading increases, conceptual learning from text will increase; (b) Motivating reading instruction will be positively associated with engaged reading, such that as students' perceptions of their teachers' support for autonomy and conceptual press increase, engaged reading will also increase; and (c) When comparing alternative theoretical models of conceptual learning from text, an indirect effects model, including engaged reading, will explain the empirical data more fully than a direct effects model that links motivating reading instruction with conceptual learning from text directly.

## Chapter III

### METHODOLOGY

#### *Purpose*

The purpose of this investigation was to examine different theoretical models of motivating reading instruction, engaged reading and conceptual learning from text. First, I expected that engaged reading would be associated with conceptual learning from text. Second, I proposed that students would perceive their teacher's support with regard to two sets of motivating reading instruction practices, conceptual press and autonomy support; I expected that motivating reading instruction would be associated with engaged reading. Finally, it was expected that a model consisting of an indirect linkage between motivating reading instruction and conceptual learning from text via engaged reading, would explain the data better than a model in which motivating reading instruction was linked directly with students' conceptual learning from text.

#### *Design*

This study examined three structural models which describe the direct and indirect associations among motivating reading instruction, consisting of conceptual press and autonomy support, engaged reading and conceptual learning from text. Prior knowledge was a control variable in this study. Measures of all variables were administered during a four-week period.

#### *Participants*

A total of 244 students (119 fourth-graders and 125 fifth-graders) from two suburban elementary schools in Maryland participated in this study. Of these students, 91% of students were Caucasian, 5% of students were African American, 2% of students

were Asian, and 2% of students were Hispanic. On the indicator of poverty, 26% of students qualified for free and reduced meals, which was comparable with the district (25.7 %). Participants represented a range of reading ability levels with students scoring in the range of the 30<sup>th</sup> percentile to the 99<sup>th</sup> percentile on the science, language usage, and reading comprehension portions of the Comprehensive Basic Skills Assessment (CTBS). Participants were proportionally equal in terms of gender, 125 (51%) were female and 119 (49%) were male. Written parental consent was obtained by means of signed informed consent forms; verbal consent was obtained from participants at the beginning of the testing.

Participants were from 15 fourth- and fifth-grade classrooms. Teachers ranged in experience from 1 to 16 years ( $M = 8.6$ ) of teaching and taught science, language arts, and other core subjects to students in self-contained classrooms containing approximately twenty-five to thirty children. Teachers generally reported utilizing a basal series for reading instruction with some supplementary use of fictional chapter book reading. Both schools used DEAR (Drop Everything and Read) time on a regular basis for 30 minutes following lunch. In addition, most teachers reported using a core science textbook as their main teaching source (*Discovery Works* by Houghton Mifflin). However, most teachers also reported supplementing their science teaching with some science information texts from the school library. Students were studying communities and animal behaviors for their spring, 2001 Earth Science units.

#### *Procedure*

Data for this dissertation study were collected in Spring, 2001. All students who obtained parental permission were given the opportunity to participate. The study was

explained to the students as being a survey of fourth- and fifth-graders' opinions about their classroom experiences in science. Students were told that all of their answers would be confidential and they did not have to answer any questions if they did not want to. A total of five students opted out of the study and read a leisure book instead. Also, students receiving special education did not participate in this study.

Teachers completed background information surveys in the classroom while students completed their tasks. Student data was gathered during two regular afternoon class sessions totaling one hour and fifteen minutes of time for each session. On day 1, students completed three questionnaires and a prior knowledge task. On day 2, students completed a strategic reading task and conceptual learning from text measure. In the following section, I describe the measures used in this study.

### *Measures*

Four measures were administered to students over two school days. The first measure, the Perceptions of Motivating Reading Instruction Survey (PMRIS), was developed by the author and pilot tested in two preliminary investigations using comparable samples (Cox & Guthrie, 2000a; Cox & Guthrie, 2001b). The other three measures used in this study are well established and have been used in many empirical studies (see Guthrie & Cox, 2001b for details). Included among these three measures were abbreviated or modified versions of the Motivation for Reading Questionnaire [MRQ] (Wigfield & Guthrie, 1997); the Reading Amount Inventory [RAI] (Guthrie, Wigfield et al., 1999); and a Reading Performance Assessment (Guthrie et al., 1998). The Reading Performance Assessment included a measure of prior knowledge, strategic reading, and conceptual learning from text. In previous studies using comparable samples

and in the current study, these measures demonstrated adequate psychometric properties. Each of the measures is described in detail in the following sections.

### *Background Information*

Teachers were asked to complete a general information sheet indicating their students' gender, ethnicity and special education status. They also answered some very general questions about the books in their classrooms, materials and books used for science instruction and themes they were studying in science. They also completed a general information sheet regarding their gender, ethnicity, and number of years teaching in which grades.

### *The Perceptions of Motivating Reading Instruction Survey*

The Perceptions of Motivating Reading Instruction Survey (PMRIS) is a 40-item self-report instrument developed for upper elementary students to rate their perceptions of instruction with regard to their teachers' support for conceptual press and support for autonomy. All items from this measure are presented in Appendix A. Following, I present definitions, sample items, reliability and validity information.

*Conceptual press: Definition and sample items.* One portion of the PMRIS assessed students' perceptions of their teacher's conceptual press. Conceptual press refers to a teacher's support for integrating facts and principles of a domain, reorganizing incoming text information and supporting persistence during moderately challenging tasks in reading (Cox & Guthrie, 2002).

First, conceptual press involves supporting students in integrating facts and principles in a domain. Teachers who emphasize this aspect of conceptual press often use multiple examples to explain concepts. They frequently ask students to distinguish

between main ideas and supporting facts when reading and discussing text, and they may use many text sources to help students identify and integrate facts with appropriate concepts. Some sample items representing this aspect of conceptual press included: (a) My teacher uses many examples to explain concepts in science; and (b) My teacher encourages me to read many different books in science.

Second, conceptual press involves supporting students in reorganizing incoming information. When students reorganize information that they read, such as when they engage in drawing graphical representations (Chi et al., 1994; Van Meter, 2001), they gain conceptual understanding. Instruction supporting students' reorganization of incoming information may include, summarizing, illustrating ideas from text, or constructing diagrams, charts or tables. Some sample items representing this aspect of conceptual press included: (a) In science, my teacher encourages me to make charts and tables while I read; and (b) My teacher asks me to draw concept maps about my science reading.

A final aspect of conceptual press involves supporting students in persisting during challenging reading tasks. There are cognitive and affective benefits when students persist through challenging tasks (Csikszentmihalyi et al., 1993; Turner et al., 1998; Turner & Meyer, 2004). Teachers who provide this aspect of conceptual press support student persistence in completing reading tasks, regard errors as constructive, and adjust instruction to support students' press for understanding (Cox & Guthrie, 2002; Middleton & Midgley, 2002; Turner et al., 2002). In addition, the instructional emphasis is centered on supporting students to take academic risks and being effortful in the face of difficulty (Clifford, 1991). Some sample items for this aspect of conceptual press support

included: (a) My teacher encourages me to keep trying even if my science work is hard; and (b) My teacher wants me to read books that help me learn new ideas in science.

*Autonomy support: Definition and sample items.* The construct of autonomy support is prominent in theoretical frameworks of motivation (Boggiano & Katz, 1991; Deci & Ryan, 1987; Reeve et al., 1999; Reeve, Nix, & Hamm, 2003; Skinner et al., 1990). In this study, autonomy support referred to students' perception of their teacher's provision of optimal choice, ownership and personal relevancy in reading. A frequently used student-report measure of autonomy support is called the Teacher as Social Context or TASC (Belmont, Skinner, Wellborn, & Connell, 1991). The TASC contains statements which indicate students ratings of their teacher's (a) controlling behavior (coercion through force or authority; reverse coded); (b) respect (acknowledging the importance of students opinions, feelings, and agendas); (c) choice (encouraging students to follow their own interests or providing options); and (d) relevance (providing a rationale for learning activities). In this study, I have used some of the items from the Belmont et al. questionnaire, such as, "My teacher encourages me to figure out how schoolwork [my science reading] is useful." However, I also wanted to further characterize more specific qualities of choice, respect, and relevance since our theoretical knowledge of autonomy support has expanded over the past several years (Flowerday & Schraw, 2000; Reeve et al., 2003; Ryan & Deci, 2000; Stefanou et al., 2004).

There are several qualities of autonomy support described in the motivation literature as pertinent to increasing engagement. First, autonomy support includes providing optimal choice for students. Breadth of choice in this study referred to classroom practices that provide a scope of alternatives including, strategy selections and

book or topic selections (Stefanou et al., 2004). Some sample items pertaining to this aspect of autonomy support included: (a) My teacher asks me to find interesting books about my science work; and (b) My teacher encourages me to follow my own interests when I read in science. Academic significance of choice is another aspect of autonomy support that is important for cognitive and motivational outcomes (see Stefanou et al., 2004). This aspect referred to students' provision of control over central and relevant academic events in the classroom (Reeve et al., 2003; Stefanou et al., 2004; Turner et al., 1998). A sample item representing this aspect of autonomy support included: (a) My teacher asks me to make important choices in science.

Another aspect of autonomy support is ownership, which involves allowing students to direct curricular decisions in the classroom (Au, 1998). This aspect of autonomy support regards students as experts and co-distributors of significant knowledge. Some sample items representing ownership included: (a) My teacher encourages class discussions about my science reading; and (b) My teacher asks me to decide whether I understand what I read in science.

A final aspect of autonomy support involves teacher support in helping students create their own personal goals for learning and is akin to Belmont and colleagues (1991) conceptualization of relevance. This aspect of autonomy support referred to how well the teacher connected learning activities with students' interests and personal goals and some sample items included: (a) My teacher helps me to create my own personal goals for learning science; (b) My teacher encourages me to do my own independent research in science; and (c) My teacher encourages me to figure out how my science reading is useful.

*Items, format, and scoring.* Students responded on a 4-point Likert-type scale with the responses, 1 = *never*, 2 = *almost never*, 3 = *sometimes*, and 4 = *a lot*. Students were instructed to respond with reference to their perception of teacher practices during science time. High scores on the subscales indicated higher levels of teacher support for conceptual press and autonomy in the classroom during science instruction. Scale means and standard deviations are presented below.

*Procedure.* All items were administered by reading them aloud with a class of students in order to account for varying degrees of reading ability. The questionnaire administration included two practice items to acquaint students with the items and response format. Students were given the following directions:

The purpose of this questionnaire is to find out the kind of reading and science work you do in school. I will be asking questions about your reading during science time. I will read the questions out loud and give you time to answer. There is no right or wrong answer. If the statement is a lot like what you do during science time, circle a lot. If the statement describes something you do once in a while, circle sometimes. If the statement is like what you have done once or twice this year, circle almost never. If you never do what the statement says, circle never. I know you have been studying \_\_\_\_ in science and you have already studied \_\_\_\_\_. Please think about your science instruction when you answer these questions.

*Validity and reliability.* Pilot studies and statistical analyses were conducted to give evidence of various forms of validity (Messick, 1995), including (a) content validity;

(b) convergent and discriminant validity; and (c) predictive validity. Also, reliability data for this sample were generated. This information follows.

Three judges were selected to give evidence of content validity of the PMRIS, based on their experiences as educators and experts in the fields of educational psychology, reading, and student motivation. All three judges were assistant professors in schools of education and have published peer-reviewed research in the areas of autonomy support and support for high-level conceptual understanding. Content judges evaluated 48 items and based on the given definitions of conceptual press and autonomy support, they rated an item as belonging to one category or the other. The judges' ratings were tallied for each item and interrater agreement among the judges was 92% to 100% in the two categories of conceptual press and autonomy support. Eight items that were not categorized appropriately were removed from the survey.

Another aspect of content validity involves students' interpretations of the items. In March, 1999, a focus group of 8 students (4 girls and 4 boys) were selected to evaluate the items and format of the questionnaire (Cox & Guthrie, 2000b). Over a two-day period, students were interviewed extensively about how teachers supported learning when there was a high conceptual emphasis in their instruction, how teachers supported students' autonomy. Additionally, the focus group of students evaluated the response format of the questionnaire and gave their interpretations of the terminology used for each item in the questionnaire. Based on their feedback during these interviews, modifications to the PMRIS items were made.

With regard to convergent and discriminant validity, Cox and Guthrie (2000) conducted a study wherein 34 fifth-grade students (19 girls and 15 boys) completed the

PMRIS and a 13-item questionnaire regarding students' perception of their classroom's goal structure as a learning goal structure or a performance goal structure (see Midgley et al., 2002). An item representing a classroom learning goal structure was, "My teacher recognizes us for trying hard." An item representing a classroom performance goal structure was, "In our class, the teacher gets upset when we make a mistake on our work." The alpha coefficients for the learning and performance classroom goal structure scales in this study were .63 and .61 respectively. The alpha coefficients for conceptual press and autonomy support were .71 and .80 respectively. The overall reliability for the PMRIS was .79. The correlation of a classroom learning goal structure with the PMRIS in this dissertation study was significant ( $r = .67, p < .01$ ), showing evidence of convergent validity. Discriminant validity is based on evidence that a measure of a differing construct, in this case, classroom performance goal structure, would not be associated with the classroom practices defined herein (e.g., conceptual press and autonomy support). These classroom practices were not significantly correlated with a classroom performance goal structure ( $r = -.03$ ).

The PMRIS has been used as an independent variable. One hundred thirty-six fifth-graders (70 males and 66 females) from eight classrooms participated in a pilot study using the PMRIS (Cox & Guthrie, 2001b). Students from ethnically diverse backgrounds (50% Black, 40% Hispanic, 5% White, and 5% Asian) were administered the PMRIS and indices of reading amount and breadth (Guthrie, Wigfield et al., 1999), strategy use (Guthrie et al., 1996), and conceptual learning from text (Guthrie et al., 1998). In this study, Cox and Guthrie found that after the effects of prior knowledge was accounted for, conceptual press support was significantly associated with strategy use

(beta = .25,  $p < .01$ ) and reading strategy use was significantly associated with conceptual learning from text (beta = .29,  $p < .01$ ). In addition, after the variance of prior knowledge was accounted for, autonomy support was significantly associated with amount and breadth of reading (beta = .38,  $p < .01$ ). Twelve items were retained from this study and other items were added and modified in order to increase the predictive validity of the PMRIS for the current dissertation study.

*Scales of autonomy support and conceptual press.* In this study, factor analysis was used to form the autonomy support scale. The scores of the 20 theoretically based autonomy support items were subjected to a factor analysis with a varimax rotation and listwise deletion. The result produced 4 components with eigenvalues greater than 1. One dominant factor accounted for 19% of the variance and the eigenvalues of the other components were highly similar to each other (see Appendix B). Items with double loadings on the first factor were eliminated. The seven items representing the first factor were selected to represent the construct and contained items with factor loadings  $> .4$ . The reliability of the autonomy support scale for this sample of students was Cronbach's  $\alpha = .80$ . Means and standard deviations for the chosen factor of autonomy support items are presented in Table 2.

Table 2

*Autonomy Support Scale*

<i>Items</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
My teacher asks me to find interesting books about my science work.	1 - 4	2.44	.941
My teacher asks me to decide whether I understand what I read in science.	1 - 4	3.01	.870
My teacher encourages class discussions about my science reading.	1 - 4	3.23	.790
My teacher encourages me to do my own independent research in science.	1 - 4	2.99	.907
My teacher encourages me to figure out how my science reading is useful.	1 - 4	2.91	.940
My teacher encourages me to follow my own interests when I read in science.	1 - 4	2.75	.953
My teacher helps me to create my own personal goals for learning science.	1 - 4	2.81	.966
My teacher asks me to make important choices in science.	1 - 4	3.00	.867

*Note.*  $n = 244$ ;  $\alpha = .82$ .

Factor analysis was used to form the conceptual press scale. The scores of the 20 theoretically based conceptual press items were subjected to a principal components factor analysis with a varimax rotation and listwise deletion. The result produced 6 components with eigenvalues larger than 1. In order to more economically represent the construct, I then requested a 2-factor solution with varimax rotation, which was theoretically reasonable (see Appendix C). Items with double loadings were eliminated. The first factor contained 7 items with loadings  $> .4$ , accounting for 16% of the variance, and the second factor contained 7 items with loadings  $> .4$  and accounted for an additional 15% of the variance. The first factor represented items pertaining to conceptual press for reading in general (e.g., My teacher encourages me to summarize when I read). The second factor represented conceptual press items pertaining to more explicit integration of reading in science (In science, my teacher encourages me to make charts and tables while I read). In order to retain theoretical premise that items be specific to science instruction in order to be related to reading engagement in the domain of science, I chose the second factor to represent conceptual press. Further, the items in this factor were empirically related to engagement. Means and standard deviations for the chosen factor of conceptual press items are presented in Table 3.

Table 3

*Conceptual Press Scale*

<i>Items</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
My teacher asks me to draw concept maps about my science reading.	1 - 4	2.34	.962
My teacher asks me to explain the important ideas in my science reading.	1 - 4	3.02	.841
My teacher encourages me to read many different books in science.	1 - 4	2.48	.958
My teacher asks me to write about my science projects in a journal.	1 - 4	2.66	1.09
My teacher asks me to make predictions based on what I read in science.	1 - 4	3.41	7.56
In science, my teacher encourages me to make charts and tables while I read.	1 - 4	2.52	.914
My teacher wants me to read books that help me learn new ideas in science.	1 - 4	3.15	.890

*Note.*  $n = 244$ ;  $\alpha = .72$ .

## *Engaged Reading*

*Definition: Constituents of engaged reading.* In this investigation, engaged reading is defined as the multiple functioning of reading strategy use, reading motivation and amount of science reading. Because engaged reading represents a coordinated system of mutually supporting qualities, including affective, behavioral and cognitive, I combined three measures to represent students' engaged reading. Next, I describe briefly the importance of using multiple measures to assess engaged reading.

One goal in this study was to represent multiple dimensions of engagement in order to both predict conceptual learning from text and be predicted by motivating reading instruction. Many researchers concur with and have utilized a multi-dimensional definition of engagement (Fredericks et al., 2004; Furrer & Skinner, 2003; Guthrie, Wigfield, Barbosa et al., 2004; Turner et al., 1998) and some have begun to combine measures to represent multiple constituents of engagement (Guthrie et al., 2001; Kirsch et al., 2002; Meece et al., 1988). For example, Guthrie and his colleagues used multiple indicators to measure engaged reading in a study of grade four students' achievement on the NAEP. Constituents of engaged reading in this study included an affective aspect, reading motivation (e.g., how often do you read for fun on your own time) and a behavioral aspect, amount of reading (How often do you take books out of the school library or public library for your own enjoyment?). In addition, Meece and her colleagues (1988) measured strategic reading, such as summarizing and monitoring, to represent a cognitive constituent of engagement.

Empirical studies have shown that the aforementioned constituents of reading engagement are moderately correlated with each other. For example, Wigfield and

Guthrie (1997) and Cox and Guthrie (2001b) found positive correlations between reading amount and breadth in grades 3 and 5 and several aspects of reading motivation, including curiosity, involvement, and preference for challenge. Baker and Wigfield (1999) found similar correlations with a high minority sample of students. Further, Guthrie and his colleagues (1999) reported positive correlations between reading motivation, amount and breadth of reading, and reading strategy use. The moderate correlations ( $r = .3 - .5$ ) in these studies indicate that these components are distinguishable, yet related in important ways.

In sum, the aforementioned studies used one or more qualities of the following, motivation for reading (i.e., affective), strategic reading (i.e., cognitive), and amount and breadth of science reading (i.e., behavioral) to define and measure engaged reading. Therefore, in this study, three measures were used to assess students' engaged reading. All of the measures used to assess the three constituents of engaged reading have been used widely in empirical research and have shown adequate reliabilities with similar samples of students (Guthrie et al., 2000; Wigfield & Guthrie, 1997). Since the multidimensional constituents of engaged reading are mutually supporting processes, a composite consisting of the sum of the scores on these measures was used to represent the engaged reading construct. Following I describe the definitions, items and formats, and psychometric properties of each engaged reading measure for this sample.

*Reading motivation: Definition and sample items.* An abbreviated version of the Motivations for Reading Questionnaire [MRQ] (Wigfield & Guthrie, 1997) was used to measure students' intrinsic motivation for reading (e.g., curiosity, involvement, and preference for challenge) and reading efficacy. These particular aspects of reading

motivation were chosen because they made theoretical sense, have empirical support and have shown good predictive power in multiple studies (Cox & Guthrie, 2001a; Wigfield et al., 2004). The MRQ was also used in this study because it reflects students' domain specific motivations (i.e., reading), rather than general motivations, which often fail to represent important contextual aspects of motivation. Lastly, I used this measure because it has shown evidence of adequate psychometric properties for diverse populations of upper elementary students (Baker & Wigfield, 1999; Guthrie, Wigfield, Barbosa et al., 2004; Watkins & Coffey, 2004; Wigfield & Guthrie, 1997; Wigfield et al., 2004).

Intrinsic motivation involves being interested in a task and having the intent to engage in the task for its own sake (Ryan & Deci, 2000). Some aspects of intrinsic motivation for reading are curiosity, involvement, importance and preference for challenge (Wigfield & Guthrie, 1997). Intrinsically motivated readers express curiosity for a wide range of reading topics in order to learn about the world around them. Thus, in this study, curiosity in the domain of reading referred to students' desire to read about a particular topic. A sample item is: "If the teacher discusses something interesting, I might read more about it." Involvement in reading referred to students' enjoyment of experiencing various types of literature and expository texts. Involved readers enjoy getting fully engrossed in a book and identifying with a book's theme or characters. A sample item is: "I enjoy a long, involved story or fiction book." Preference for challenge in reading referred to students' desire to understand complex ideas from text. A sample item is: "I like hard, challenging books."

Reading efficacy is another important aspect of reading motivation. Bandura (1997) defined self-efficacy as individuals' beliefs in their capabilities to accomplish a

given task or activity. In reading this means believing one is able to read different kinds of reading materials. Self-efficacy influences a student's choice of activities to do and persistence at them, even when the activities become difficult. In the reading area, students high in reading self-efficacy tend to see difficult reading tasks as manageable and use cognitive strategies to master them (Schunk & Zimmerman, 1997). A sample item for reading efficacy is: "I am a good reader."

*Items, format, and scoring.* For each of the items from the abbreviated MRQ, students expressed their motivation to read based on a 4-point Likert-type scale with choices ranging from *very different from me* (1) to *a lot like me* (4). High scores on the subscales indicated higher levels of student motivation for reading.

*Procedure.* All items were administered by reading them aloud with a class of students in order to account for varying degrees of reading ability. The questionnaire administration included two practice items to acquaint students with the items and response format. Students were given the following directions:

The purpose of this questionnaire is to find out how you feel about reading. I will read the questions out loud and give you time to answer. There is no right or wrong answer. In the first part, the statement tells how some students feel about reading. Listen to each statement and decide whether it talks about a person who is like you or different from you. If the statement is very different from you, circle 1. If the statement is a little different from you, circle 2. If the statement is a little like you, circle 3. If the statement is a lot like you, circle 4.

*Validity and reliability.* The MRQ has been used in multiple studies (e.g., Guthrie, Wigfield, Barbosa et al., 2004; Wigfield & Guthrie, 1997). In the following section, I

report its predictive validity and content validity in this study. Also, I report reliability for this sample.

The MRQ has been used as an independent variable and a dependent variable. In a study of 59 fourth graders and 46 fifth graders, Wigfield and Guthrie (1997) used the MRQ to predict amount and breadth of students' reading. This study showed that the scales of interest in this study could be measured reliably. The alpha coefficients were as follows: reading curiosity = .76; preference for challenge = .80; reading involvement = .59; and reading efficacy = .68. In terms of predictive validity, the intrinsic composite of reading motivation and reading efficacy significantly predicted reading amount and breadth of reading in fourth- and fifth-grade children. Other studies have replicated these findings (Cox & Guthrie, 2001a).

In another study, Baker and Wigfield (1999) used the MRQ to assess the generalizability of the MRQ for fifth- and sixth-graders for a diverse population of students. In addition, they investigated how well the MRQ predicted achievement for both a traditional standardized reading test and a reading performance assessment. This study indicated that different aspects of reading motivation could be measured reliably; internal consistency reliabilities of the intrinsic reading motivation scales and reading efficacy scale ranged from .66 to .76. This study also presented converging evidence that the intrinsic motivation for reading and reading efficacy scales from the MRQ correlated with children's amount and breadth of reading. In addition, Baker and Wigfield (1999) found the relations of reading motivation to reading comprehension to be strong for a performance type assessment. This current dissertation study used a performance

assessment, rather than standardized reading test as a measure of students' conceptual learning from text.

In another study, Guthrie and his colleagues (2000) used the MRQ as a dependent variable. In this study, the dimensions of curiosity, involvement, and preference for challenge were combined to create an intrinsic motivation composite. The 17 items representing this composite had a Cronbach's alpha reliability of .86. Guthrie and his colleagues (2001) found that instructional contexts (e.g., CORI verses traditional reading instruction) had differential effects on students' reading motivation. In classrooms where motivation and strategy use was promoted (CORI), students were significantly higher in curiosity, a sub-scale of the MRQ. In this dissertation study, since it was hypothesized that as engaged reading increases, conceptual learning from text would increase, it was important that the MRQ had been successfully used as a dependent variable.

Watkins and Coffey (2004) conducted a study to replicate the factor structure of the MRQ with two large samples of third-, fourth-, and fifth-grade students. Although they were critical of an 11-factor multidimensional structure because specific factors did not fully replicate over their two samples, they did provide additional empirical evidence for using multidimensional aspects to study reading motivation rather than using a domain-general approach. They found that at least 8 factors over two large samples replicated. The items used in this dissertation study (e.g., efficacy, curiosity, and preference for challenge) were items that have factored consistently in previous studies (Guthrie, Wigfield, Barbosa et al., 2004; Watkins & Coffey, 2004; Wigfield et al., 2004).

Factor analysis was used to form the motivation for reading scale used in this study. The scores of the 22 theoretically based motivation to read items were subjected to

a principal components factor analysis with a varimax rotation and listwise deletion. Two dominant components emerged with eigenvalues larger than 1, consisting of items representing intrinsic motivation to read and reading efficacy and accounted for 22.7 % of the variance. The eigenvalues of the other components were highly similar to each other. Items from the first and second factors with double loadings were eliminated. Nine items in the first and second factors with loadings  $> .4$  were selected to represent reading motivation and reading efficacy. The reliability of the motivation for reading scale for this sample of students was Cronbach's  $\alpha = .78$ . Means, standard deviations and factor loadings for reading motivation are presented in Table 4.

Table 4

*Motivation for Reading Scale*

<i>Item</i>	<i>Aspect of reading motivation</i>	<i>Range</i>	<i>M</i>	<i>SD</i>	<i>Factor Loading 1</i>	<i>Factor Loading 2</i>
I am a good reader.	Reading efficacy	1 - 4	3.52	.721	.695	
I learn more from reading than most students in my class.	Reading efficacy	1 - 4	2.66	1.02	.639	
I know that I will do well in reading next year.	Reading efficacy	1 - 4	3.37	.820	.565	
I like hard challenging books.	Intrinsic motivation	1 - 4	2.87	1.02	.639	

Table 4 (continued)

*Motivation for Reading Scale*

<i>Item</i>	<i>Aspect of reading motivation</i>	<i>Range</i>	<i>M</i>	<i>SD</i>	<i>Factor Loading 1</i>	<i>Factor Loading 2</i>
If the project is interesting, I can read difficult material.	Intrinsic motivation	1 - 4	3.05	.988	.469	
If the teacher discusses something interesting, I might read more about it.	Intrinsic motivation	1 - 4	3.34	.801		.710
I like it when the questions in books make me think.	Intrinsic motivation	1 - 4	2.80	1.01		.525
I usually learn difficult things by reading	Intrinsic motivation	1 - 4	3.17	.914		.497
If a book is interesting, I don't care how hard it is to read.	Intrinsic motivation	1 - 4	3.23	.950		.455

*Note.*  $n = 244$ ;  $\alpha = .78$ .

*Amount and breadth of reading: Definition and sample items.* The second indicator of engaged reading is amount and breadth of science reading. In this investigation, amount and breadth of reading referred to wide and frequent reading in the domain of science. Students answered questions about their amount of science reading using a modified version of the Reading Activity Inventory [RAI] (Guthrie, Wigfield et al., 1999). The RAI is a 21-item self-report questionnaire that measures amount and breadth of school and enjoyment reading. In this study, all of the items were modified to make them domain specific in the area of reading for science. Therefore, in this study, school reading referred to time spent reading about science topics in school. Reading for enjoyment referred to time spent reading science topics for personal interest.

There are multiple ways to measure amount and breadth of reading, including activity diaries, self-report questionnaires, and print exposure measures. Although print exposure methods may reduce social desirability effects, a limitation of the print exposure method is that the titles and authors are limited to fiction books, and thus does not capture school science reading very well. Given the number of students participating in this investigation, activity diaries would have been extremely labor intensive and they are also prone to social desirability. Although social desirability is a concern, it has been shown that the questionnaires, such as the Reading Activity Inventory (RAI) are comparable psychometrically to print exposure methods; they have demonstrated adequate internal consistencies and predictive validity in multiple studies (e.g., Cox & Guthrie, 2001a; Wang & Guthrie, 2004).

*Items, format, and scoring.* The modified RAI consisted of two sections: science reading for school and science reading for enjoyment. With regard to science reading for

school, items request students to report whether they had read a given topic about science for school and if so, how often. The first question is, "Have you ever read a science textbook for school? Students gave a "no or yes" response. Next, students were asked to be more specific: "If yes, write in the title, author, or specific topic that you read about." Space was given for their response. Students who answered "no" were given 1 point, students who responded "yes" were given 2 points, and students who gave specific information about a topic were given 3 points and students who stated either a specific author or title were given 4 points. In addition, titles of books that were repeated across questions were not coded twice. The second question assessed the frequency of reading a particular type of science text. For example, a sample item is, "How often do you read a science textbook for school?" Students responded on a 4-point scale consisting of 1 = *almost never*, 2 = *about once a month*, 3 = *about once a week*, 4 = *almost every day*.

In the second section of the questionnaire, students reported on the topics and frequency of their science reading for enjoyment. In a similar fashion, students were asked whether they read a science book for enjoyment and if so, how often. The first question read, "For enjoyment, have you ever read a science book?" Students responded with a "no or yes." Next, students were asked: "If yes, write in the title, author, or specific topic that you read about. Space was given for the response. The coding of these items were the same as the school items; 1 = *no*, 2 = *yes*, 3 = *topic indicated*, 4 = *title or author indicated*. The frequency item followed, "How often do you read a science book for enjoyment?" The response format consisted of a 4-point scale, 1 = *almost never*, 2 = *about once a month*, 3 = *about once a week*, 4 = *almost every day*.

*Procedure.* The questionnaire administration included two practice items to acquaint students with the items and response format. All items were administered by reading them aloud with a class of students in order to account for varying degrees of reading ability. When administering this particular assessment, a book was shown to students before each question was read as a way to prompt students to think about different genres of science reading. For example, one question asked about fiction stories in science, thus a fiction story was held up as an example to understand the genre type. Students were given the following directions:

The purpose of this questionnaire is to find out how many and what types of books you like to read at home and at school. This is important for me to understand the kinds of reading fourth- and fifth-graders do. I will read the questions out loud and give you time to answer. First I will ask if you read a particular type of book and you answer no or yes. Then I will ask you to write the title of the book, who wrote the book, or what the book was about. Then, I will ask how often you read that type of book.

*Validity and reliability.* The RAI has been used in multiple studies (e.g., Guthrie, Wigfield, Barbosa et al., 2004; Wigfield & Guthrie, 1997). In the following section, I report its predictive validity and content validity in this study. Also, I report reliability for this sample.

The RAI has been used both as a dependent variable and an independent variable. For example, in an investigation studying the relations between student motivation for reading and their amount and breadth of reading, Wigfield and Guthrie (1997) used the RAI as a dependent variable. They found that children with high intrinsic motivation read

more and with more breadth than children with lower intrinsic motivation. Other studies have also reliably used the RAI as a dependent measure (Cox & Guthrie, 2001a; Guthrie, Wigfield, et al., 1999). In addition, the RAI has been used as an independent variable to predict passage comprehension and conceptual learning from multiple texts (Baker & Wigfield, 1999; Guthrie, Wigfield et al., 1999). For example, using a multiple regression analysis, Guthrie and his colleagues showed that the RAI significantly predicted conceptual learning from multiple texts after controlling for the effects of past reading achievement and prior knowledge.

The scores of the 24 theoretically based amount and breadth of reading items were subjected to a principal components analysis with a listwise deletion. The homogeneity of these items was indicated by the finding that the lowest factor loading was .51 and the median loading was .69. The reliability of the amount and breadth of science reading scale for this sample of students was Cronbach's  $\alpha = .82$ . Means and standard deviations for the items on the amount and breadth of science reading scale are presented in Table 5.

Table 5

*Amount and Breadth of Science Reading Scale*

<i>Items</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
Have you ever read a science textbook for school?	1 - 4	3.64	0.84
How often do you read a science textbook for school?	1 - 4	3.16	0.87
For school, have you ever read an information book about science?	1 - 4	2.54	1.19
For school, how often do you read information books about science?	1 - 4	2.26	1.07
Have you ever read a plant or animal book for school?	1 - 4	2.45	1.12
How often do you read plant or animal books for school?	1 - 4	1.78	0.91
For school, have you ever read a fiction story in science?	1 - 4	2.18	1.32
For school, how often do you read a fiction story in science?	1 - 4	1.62	0.87
For school, have you ever read a reference book about a science topic?	1 - 4	1.86	1.12
For school, how often do you read reference books about science?	1 - 4	1.55	0.88
For school, have you ever read a library book about a science topic?	1 - 4	2.39	1.15
How often do you read library books about science topics?	1 - 4	1.91	0.96
For school, have you ever read a book for a science project?	1 - 4	2.11	1.22
How often do you read books for school science projects?	1 - 4	1.59	0.87
For enjoyment, have you ever read a science book?	1 - 4	2.13	1.20
How often do you read a science book for enjoyment?	1 - 4	1.82	0.99
For enjoyment, have you ever read a story about a scientist?	1 - 4	1.43	0.97
How often do you read stories about scientists for enjoyment?	1 - 4	1.19	0.49
For enjoyment, have you ever read a science book you found in the public library?	1 - 4	1.67	1.06
How often do you read science books from the library for enjoyment?	1 - 4	1.35	0.69
How often do you read about science on the Internet?	1 - 4	1.34	0.74

Table 5 (continued)

*Amount and Breadth of Science Reading Scale*

<i>Items</i>	<i>Range</i>	<i>M</i>	<i>SD</i>
Have you ever read any other kind of science book for your own interest that was not mentioned?	1 - 4	1.78	1.16
How often do you read this kind of book for your own interest?	1 - 4	1.49	0.84

*Note.*  $n = 244$ ;  $\alpha = .82$ .

*Strategic reading.* A performance indicator of strategic reading was used to measure the cognitive constituent of reading engagement. Empirical work on reading strategy use indicates its important benefits on conceptual learning from text (Baker & Brown, 1984; Palincsar & Brown, 1984; Paris, Lipson, & Wixon, 1983; Paris et al., 1991; Pressley et al., 1992). Specifically, researchers point to the importance of being able to search through a range of texts and documents in order to locate information and integrate information from multiple sources.

In this study, the measure of strategic reading assessed the extent to which students chose relevant information to read from a multiple text passage and the quality of notes written in summary form about the relevant section. This measure of strategic reading was given as a portion of a performance assessment reading task which has been used in previous investigations (Guthrie et al., 1996; Guthrie et al., 1998). The performance assessment packet that students completed including the measures of reading strategy use, prior knowledge, and conceptual learning from text is described in the following section.

### *Performance Assessment Reading Measures*

*Overview.* A performance assessment task was given to assess students' prior knowledge (i.e., control variable), strategic reading (i.e., cognitive constituent of engaged reading), and conceptual learning from text (i.e., dependent variable) in the science domain. This performance assessment measure has been used widely with upper elementary students (Guthrie et al., 1998; Guthrie, Wigfield et al., 1999). The task consisted of a reading packet representing multiple trade books. The topic of the assessment was ponds and deserts; a science topic that is familiar under the fourth- and fifth-grade curriculum in the county.

The packet contained 46 pages in 14 sections, with ten sections relevant to the topic and four distracter sections. The packet included multiple texts of varying degrees of difficulty; it contained an equal number of easy (Grade 2 - 3) and difficult (Grade 4 - 6) texts, representing important concepts and defining information on the two biomes. Each section of the packet contained approximately one to five pages of information. The packet also included important text features for aiding conceptual knowledge acquisition, including headings, diagrams, tables, illustrations. Further, it contained important information text features, such as a table of contents, an index, and a glossary of important vocabulary words contained within the text, which are all important for reading comprehension. The packet provided the text base for the assessments of strategic reading and conceptual learning from text. In the following sections, I describe each of the measures associated with the performance assessment reading task.

### *Prior Knowledge*

Since there is a moderate to strong relation between prior knowledge and conceptual learning from text (Alexander, Kulikowich, & Jetton, 1994; Dochy et al., 1999), prior knowledge was used as a control variable in this study.

*Definition.* In this study, prior knowledge referred to a reader's pre-existing knowledge base including, topical knowledge of ponds and deserts, knowledge of paragraph writing, and general knowledge about the domain of ecological science. Prior knowledge was measured with an open-ended writing task.

*Procedure.* The performance assessment task was introduced with an observational activity. The purpose was to help students activate their prior knowledge about the ponds-desert reading topic. Students were given a colored picture of a pond with fish, insects, birds, and trees. For this task, students were asked to observe the picture and with a partner, students were asked to discuss what they observed in the illustration. They were given five minutes to complete this activity. After viewing the picture, students worked independently to write about their knowledge of the topic in the picture. They were given 10 minutes to complete this open-ended writing activity. I read the directions aloud, asking students to follow along with the directions written on the assessment, "In the space below, explain how ponds are different from deserts. When writing, you may want to think about the following questions: (a) What is a pond like? (b) What is a desert like? (c) How are they different?" After 7 minutes of writing, students were prompted, "You are doing well. Keep writing if you can."

*Example prior knowledge essay.* Following is an example of the written prior knowledge statement of a fourth-grade student:

A pond is wet and has seaweed, fish, crabs, and amphibians like otters and ducks. I know this because I went scuba diving in a pond. In a desert, it's hot and dry and it has cactuses, snakes, and squarepions. I know this because I've seen it on the Discovery Channel. Deserts are like dried and fried land.

*Scoring.* Students' performance on the prior knowledge assessment was rated on a knowledge hierarchy rubric (see Appendix D). The hierarchy levels ranged from one to eight. A score of 1 (Level 1) indicated low prior knowledge evident in the essay, which consisted of two or less simple facts. A score of 8 (Level 8) indicated high prior knowledge evident in the essay, which consisted of explanatory concepts of both systems (i.e., pond and desert). The student essay presented in the example received a score of 3, indicating the inclusion of seven or more features of either biome; or three or more features of either biome and one within system relation (i.e., fish live in water). The third level is characterized by facts and classifications typically presented as a list of organisms. Such classifications are present in the preceding example. The rubric used for this scoring scale is described in Table 6.

Table 6

*Knowledge Hierarchy Rubric*

<i>Level of Knowledge</i>	<i>Description</i>
Level 1-Minimal facts	Two or less facts about either domain presented
Level 2-Expanded facts	Three to six facts about either domain presented
Level 3-Facts and simple descriptions	Multiple facts about either domain and one within system relation presented
Level 4-Factual information and within system relations	Seven-plus facts about either domain are presented along with more than one within system relation
Level 5-Factual information, within system relations, and between system relations	Seven-plus facts about either domain are presented along with multiple within system relations and one between system relation
Level 6-Factual information, within and between system relations, and at least one explanatory concept	Seven-plus facts about either domain are presented along with multiple within and between system relations and one explanatory concept
Level 7-Explanatory concepts in one system only	Multiple facts about either domain are presented along with multiple within and between system relations and at least two explanatory concepts in one biome
Level 8-Explanatory concepts in both systems	Multiple facts about either domain are presented along with multiple within and between system relations and explanatory concepts in both biomes are presented

*Validity and reliability.* In terms of predictive validity for this measure was used in previous studies. In one study of a comparable sample (Guthrie et al., 1998), prior knowledge and conceptual learning from text were correlated,  $r(90) = .46, p < .01$ . Similar correlations were found in other studies using comparable samples (e.g., Guthrie et al., 1996). This moderate correlation is also similar to those found by Gottfried (1985) for reading-related measures for third- and fourth-grade children.

Inter-rater agreement is an index of reliability used for measures of this sort. It represents an estimate of similarity of ratings between two or more raters. Two independent raters coded student prior knowledge essays. Student essays were read and responses were coded according to the number of: (a) biome features present; (b) within system relations present; (c) between system relations present; and (d) explanatory principles or concepts present. Inaccuracies at the feature level and misconceptions at the concept level were also coded. Exact agreement was computed to report whether the raters concurred on the knowledge rubric level for a given response. Adjacent agreement was computed to report whether raters disagreed by one or less on the level of a response. Interrater reliability for this task was 80% exact agreement and 100% adjacent agreement.

### *Strategic Reading*

Recall that strategic reading is a cognitive constituent of engaged reading in this study.

*Definition.* In this investigation, strategic reading involved the extent to which students chose relevant information to read from a multiple text passage and the quality of notes written in summary form about the relevant section.

*Procedure.* In the next phase of the performance assessment, students were given the general task of explaining the differences between ponds and deserts. Students were given the Pond-Desert packet described earlier. Ten of the packet sections were directly relevant to learning about the differences between ponds and deserts and four sections contained irrelevant information. Students were free to use the table of contents, index, headings, and illustrations to locate information relevant to the guiding questions. Students were given a log to record the sections they chose to read. The log also included an area to take notes on the section read. I read the directions aloud to the students as they read along. Following are the directions:

Here is a book to read. Read the information in this book so you can explain how ponds are different from deserts. Some of the chapters will be useful, some will not. Choose the ones that you think will be important and useful to explain ponds and deserts. For each part, write the letter of the chapter you read and take notes on the chapter in the space below it. Remember, you are reading to help explain how ponds are different from deserts. What is a pond like? What is a desert like? How are they the same? How are they different? Now let's try one together. Look at the table of contents in your packet. Suppose we wanted to learn more about deserts. One section we may want to read is named "Desert Climate."

This section in the table of contents is labeled E. Everyone find the section E in the table of contents. Point to it. Now look at your search log. Everyone point to the line where you think you should write the section letter E. When you have found the line, write the letter on that line. Now look back at the table of contents. Point to the page number where section E begins. That page is 10. Turn to that

page and begin reading the whole section. Section E is 8 pages long. As you read this section, write your notes by the word “notes.” You do not have to worry about spelling and punctuation.

As indicated above, students were provided with scaffolding to complete one section of text together, first reading, and then recording what was learned from the section. After completing the example, students were given the following direction:

Now use your packet to learn about ponds and deserts. You choose the sections of the packet you want to read. Do this just like you did the last one. Read to answer these questions. How are ponds different from deserts? What is a pond like? What is a desert like? How are they the same? How are they different?

Students were provided with five pages of note taking space. Students worked independently on this task for 25 minutes. After 15 minutes students received a prompt that they were doing well and to continue learning about the differences between ponds and deserts.

*Example notes.* Following is an example of the written notes of a fourth-grade student learning about ponds and deserts. After reading section L, a relevant section entitled “Animals in the Desert,” the student recorded the following notes: “Animals like the hot dry desert. Pocket mouse, badger, bullsnake, kangaroo rat, kit fox, camels.” This student recorded information regarding 5 sections of relevant text. There were no irrelevant sections chosen.

*Scoring.* Students’ search for information was indicated by the number of relevant and irrelevant sections of the booklet that students chose to read. This provided a measure of discriminant validity reported later.

The quality of written summaries about each relevant section read provided a score for strategic reading. With regard to the coding of student summaries, two raters coded the content of each set of notes in the following way: (a) a score of 1 indicated that no notes were written in the space provided; (b) a score of 2 indicated that features of the biome were presented. To receive this score, the student presented a combination of physical features or functions of one or both of the biomes (e.g., water, fish, cactuses, and lizards). However, no relations were presented. Also, scientifically inaccurate information may have been included to receive this score; (c) a score of 3 indicated that simple relations were presented. The student presented several characteristics of one biome with relations between them implicitly illustrated through comparison. However, no explanatory principles for these relations were present; (d) a score of 4 indicated that explanatory principles for one system were presented. In the notes, the student presented several relevant characteristics of one system with the relations described explicitly; (e) a score of 5 indicated that explanatory principles contrasting two systems (e.g., ponds and desert contrast) were presented. The student presented multiple characteristics of each system and described explicit relations for both systems.

Students' content scores were summed and the mean of these scores represented a student's strategic reading. Higher scores indicated higher levels of strategic reading.

*Validity and reliability.* In this dissertation study, discriminant validity was indicated by the dual conditions of: (a) a positive correlation of  $r(243) = .23, p < .01$  between number of packet sections that were selected by the students as relevant to the topic of search and conceptual learning from text, and (b) a negative correlation  $r(243) = -.27, p < .01$  for number of irrelevant sections selected and conceptual learning from text.

Two independent raters scored the strategic reading portions of this study. Inter-rater reliability was computed for exact agreement and adjacent agreement. Adjacent agreement means raters disagreed by one or less on the coding of a response. Exact inter-rater reliability was as follows: (a) searching for information, 100%; and (b) content summaries, 86%. Adjacent reliability was 100% for the two scoring procedures.

### *Conceptual Learning from Text*

*Definition.* In this dissertation study, conceptual learning from text was the dependent variable and was defined as the new knowledge that students gain after reading an expository text. Conceptual learning from text was measured through coding the level of knowledge presented in a students' written essay.

*Procedure.* The last phase of the performance assessment task involved students writing an essay about the similarities and differences between ponds and deserts. After reading and taking notes from the multiple text packet described in the previous section, students were given 25 minutes to complete an open-ended writing activity. Students handed in all materials, text and notes, before the final writing commenced. Directions were read aloud while students followed along reading the directions written on the assessment,

In the space below, explain how ponds are different from deserts. When writing, you may want to think about the following questions: (a) What is a pond like? (b) What is a desert like? (c) How are they different? Write everything you know.

You have 25 minutes.

After 7 minutes and after 15 minutes of writing, students were prompted, "You are doing well. Keep writing if you can." Student essays were collected after 25 minutes.

*Example conceptual learning from text essay.* Following is an example of the written knowledge statement of a fourth-grade student who received a rubric coding of level 5:

Today I learned about ponds and deserts. Ponds and deserts are different in many ways. In the desert there are lots of interesting animals to know. There is a bull snake, kit fox, and a kangaroo rat. In a pond are fish, tadpoles, and frogs and around a pond is a white tail deer and a fishing spider. Most plants and animals in a pond are microscopic. A deserts climate is usually very hot. Sometimes it doesn't rain for a whole year. If it does rain, it rains so hard and fast that when it hits the surface it runs. The rain doesn't sink into the ground. The desert only gets 10 inches of rain all year. Sometimes it rains all of that in the night. Or it could just rain in the day. The pond supports food and water for the plants and animals. In the desert some animals go underneath rocks to keep away from the hot sun and some animals burrow under the ground to keep away from the heat. Ponds and deserts are different in many ways.

*Scoring.* Students' performance on the conceptual knowledge essay was rated on the same knowledge hierarchy rubric presented earlier for prior knowledge scoring (e.g., see Table 6). The hierarchy levels ranged from one to eight. A score of 1 (Level 1) indicated low conceptual learning from text was evident in the essay, which consisted of two or less simple facts. A score of 8 (Level 8) indicated high conceptual learning from text was evident in the essay, which consisted of explanatory concepts of both systems (i.e., pond and desert). The student essay presented in the previous example received a

score of 5, indicating the inclusion of seven or more features of either biome along with multiple within-system relations and one between-system relation.

*Validity and reliability.* This measure's concurrent validity was indicated by previous research. In two studies with comparable samples, conceptual learning from text measured by the same performance assessment correlated with a standardized reading test .28 (Guthrie, Anderson et al., 1999) and with reading grades .39 (Sweet, Guthrie, & Ng, 1998).

With regard to reliability, two independent raters coded student essays. Responses were coded according to the number of: (a) biome features present; (b) within-system relations present; (c) between-system relations present; and (d) explanatory principles or concepts present. Inaccuracies at the feature level and misconceptions at the concept level were also coded. Exact agreement was computed to report whether the raters concurred on the knowledge hierarchy rubric level for a given response. Adjacent agreement was computed to report whether raters disagreed by one or less on the knowledge level. Interrater reliability was 80% exact agreement and 100% adjacent agreement.

## Chapter IV

### RESULTS

#### *Descriptive Statistics and Preliminary Analyses*

The first hypothesis in this study was that engaged reading and conceptual learning from text would have a positive association, such that as engaged reading increases, conceptual learning from text would increase. Table 7 presents zero order correlations, means and standard deviations for each primary variable in the study. As the table depicts, engaged reading was positively correlated with conceptual learning from text,  $r(243) = .36, p < .01$ . In subsequent structural equation modeling analyses, the standardized path coefficient between engaged reading and conceptual learning from text will be reported.

Table 7

#### *Correlations among the Primary Variables*

Variables	1	2	3	4	5
1. Conceptual learning from text	1.00				
2. Prior knowledge	.52**	1.00			
3. Engaged reading	.36**	.17	1.00		
4. Autonomy support	.05	.07	.23**	1.00	
5. Conceptual press	.08	.08	.19**	.68**	1.00
mean	4.00	2.27	10.53	23.30	19.65
standard deviation	1.25	.846	1.64	4.61	3.83

*Note.*  $n = 244$ ; \* $p < .05$ . \*\* $p < .01$ .

The second hypothesis in this study was that as students' perceptions of their teachers' motivating reading instruction increased, engagement in reading would increase students' engaged reading. Autonomy support was significantly correlated with engaged reading,  $r(243) = .23, p < .01$ . In addition, conceptual press was significantly correlated with engaged reading,  $r(243) = .19, p < .01$ . In the following analysis, the standardized path coefficient between motivating reading instruction and engaged reading will be reported.

#### *Testing a Hypothesized Self-Process Model of Engagement in the Reading Domain*

The third hypothesis was that a model including indirect effects between motivating reading instruction and conceptual learning from text via engaged reading would fit the empirical data better than a model containing only direct effects between motivating reading instruction and conceptual learning from text. To examine the third hypothesis, structural equation modeling (SEM) was used to compare the alternative theoretical models. Unlike methods such as multivariate regression, SEM takes into account the relative contribution of measurement error in terms of simultaneous (i.e., structural) covariance relations between and among the variables and constructs in the models. As well, SEM allows for more analytic precision because the measurement error is separated from the effects being measured and thus reduces possible contamination of the true scores of the observed variables (Bentler & Chou, 1987).

*Overview of the analysis.* The procedure recommended to address this question consisted of a sequence of comparing models (Bentler, 1997; Mueller, 1997; Mulaik & Millsap, 2000). Each model was tested for its fit to the data. The first step was to test the measurement portion of the model. First, a test to confirm the measurement model of the

latent constructs, conceptual press and autonomy support, was conducted. Next, a test to confirm a second-order factor structure was conducted. It was hypothesized that conceptual press and autonomy support underlie a latent construct called motivating reading instruction. This hypothesis was confirmed by comparing three nested measurement models with varying dimensionalities.

In the next step, the a priori hypothesized structural model was tested to ensure that the empirical data fit the theoretical model of independent and dependent factors and variables put forth in this study. Fit was determined by using various indices that are described later. A goodness of fit report of a model gives information indicating that the hypothesized model is but one viable representation of the true relations among variables and factors.

If it is determined that the hypothesized model fits the data well, the next step is to test the hypothesized model against an alternative theoretical model to determine which model has a “better” fit to the data. In structural equation modeling, models that are not nested cannot be directly compared. Nested models are hierarchically related to one another in the sense that one is a subset of another (Byrne, 1994). In this study, the hypothesized indirect effects model could not be directly compared with the direct effects model. Thus, both the direct effects model and the indirect effects model were compared to a saturated model (e.g., the least restricted model) because they were both nested within it. Because it is the least restricted model, the saturated model necessarily provides a near perfect fit to the data. In this study, the two alternative models were compared back to the saturated model. Since the comparison models were nested within the saturated model, the difference in chi square ( $\Delta\chi^2$ ) and  $\Delta df$  could be tested statistically.

The best theoretical model will be the model that is least statistically different from the saturated model. In the following section, I describe the measurement phase of testing for this study.

#### *Model Specification and Fit Indices*

The sample size of this study ( $n = 244$ ) was larger than the cut-off value of 200 participants as suggested by researchers for producing stable results (Bentler & Chou, 1987). Structural equation modeling assumes that the data have a multivariate normal distribution. In this study, the skewness and kurtosis values indicated that the assumption of normality was not violated. Consequently, the default procedure of the maximum likelihood method of estimation was used for these analyses (Bentler, 1997; Bentler & Chou, 1987).

There were three latent variables and three observed variables in this study. Conceptual press and autonomy support were latent factors, which were hypothesized to form a higher-order latent factor called motivating reading instruction. In the measurement phase of testing, separate confirmatory factor analyses were conducted to confirm the hypothesized structure of the latent factors. In this study, two measurement models were evaluated. The measurement models were evaluated using three indicators of “goodness of fit”. The chi-square ( $\chi^2$ ) test is the most commonly used measure of model fit and assesses the model's goodness or badness of fit in a null hypothesis sense. A large  $\chi^2$  value with a significant  $p$  value suggests a poor fit of the model to the data. Since the  $\chi^2$  test is sensitive to sample size, other fit indices are used in conjunction with it.

A second particularly good index is the Steiger's Root Mean-Square Error of Approximation (RMSEA; MacCallum, Browne & Sugawara, 1996). This index is relatively insensitive to sample size because it has an explicit parsimony adjustment. The RMSEA is a population-based index of badness of fit for which zero would indicate a perfect fit and values of .05 or less, are considered acceptable (Bentler, 1997). One advantage of the RMSEA is that it gives a confidence interval. If the upper limit of the 90% confidence interval lies below .10, one can conclude that the model fits acceptably in the population (MacCallum, Browne & Sugawara, 1996).

A third goodness of model fit index is the Comparative Fit Index (CFI; Bentler, 1990). The CFI assesses how much improvement the proposed model makes relative to a model in which the variables are completely uncorrelated. The CFI ranges from 0 to 1, with values that are equal to or greater than .96 (Hu & Bentler, 1999) indicating the model represents a good fit to the data.

### *Empirical Construction of Latent Variables*

*Measurement model for conceptual press.* In the first phase of this analysis, the confirmatory factor model for conceptual press was imposed upon the covariance matrix (derived from the questionnaire items). When testing this model, the path to "My teacher asks me to make predictions based on what I read in science," was fixed at 1.00 and was not estimated. Fixing one indicator for each latent variable allows the model to be properly identified. The rest of the parameters of interest were left free to be estimated. After the initial model specification, I made three adjustments to covary residuals that were theoretically justifiable and statistically significant based on results from the Lagrange Multiplier Test (LM). A covariance was included between two residuals, "My

teacher asks me to draw concept maps about my science reading” and “My teacher encourages me to make charts and tables while I read”, because both items involve the information reorganization aspect of conceptual press. I also added an error covariance between “My teacher asks me to draw concept maps about my science reading” and “My teacher asks me to explain the important ideas in my science reading,” again depicting the information reorganization aspect of conceptual press. Finally, the LM test also showed a correlation between writing about science projects in a journal and making predictions based on science reading, which made theoretical sense. I allowed these residuals to covary because predicting is one of the science processes about which students typically write in a journal.

The final fit of this measurement model is described in Figure H.

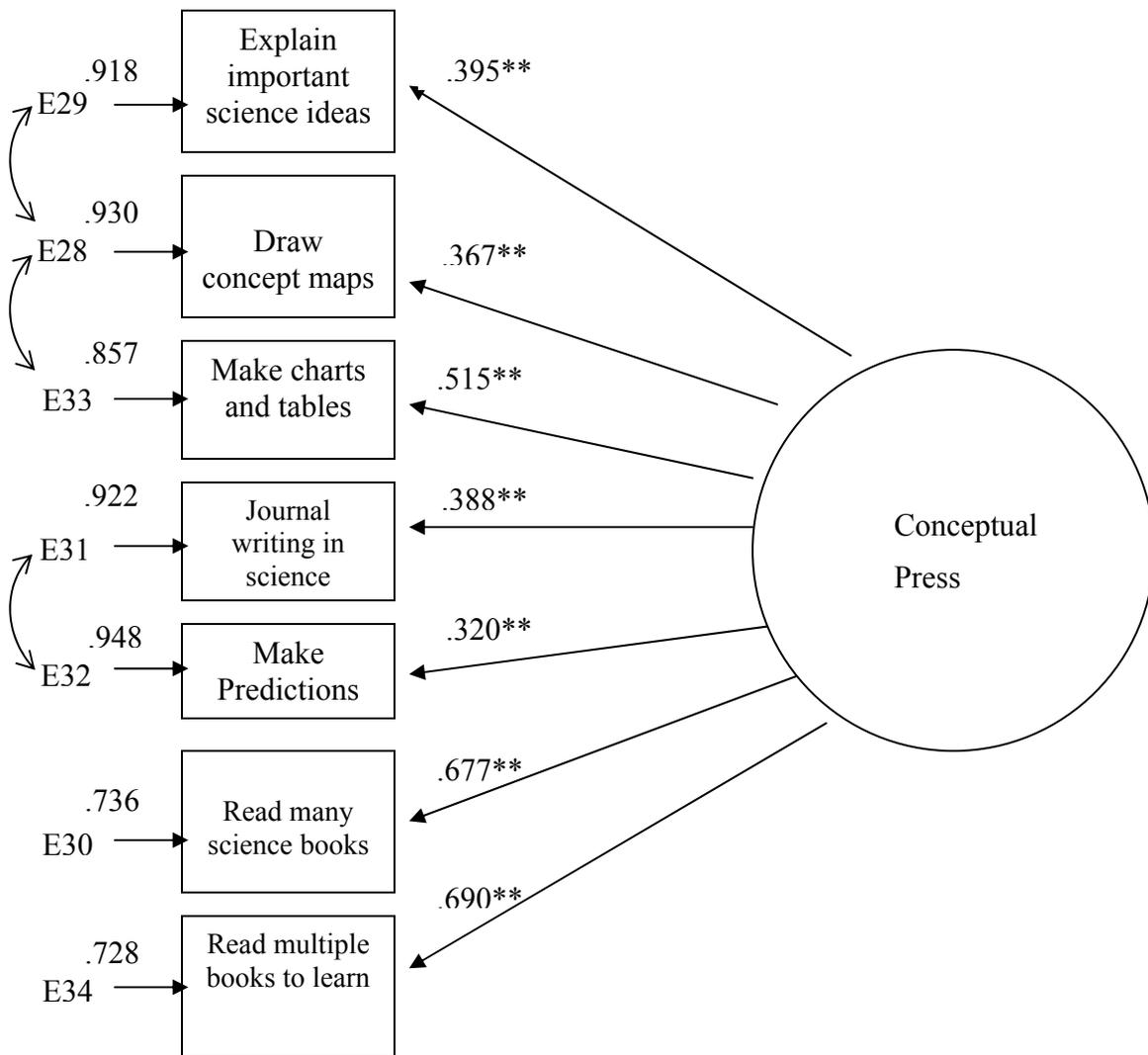


Figure H. Measurement model of students' perceptions of their teacher's conceptual press.

$\chi^2 (11, n = 244) = 16.968, p = .10 (ns)$ , Root Mean Square Error of Approximation (RMSEA) = .04, Comparative Fit Index (CFI) = .98. The correlation between the error terms for concept mapping and explaining important science ideas was .26\*. The correlation between the error terms for concept mapping and making charts and tables was .19\*. The correlation between the error terms for journal writing in science and making predictions was .21\*; \* $p < .05$ ; \*\* $p < .01$ .

As indicated in Figure H, the model chi square and its associated nonsignificant  $p$ -value indicates that the model fits well  $\chi^2 (11, n = 244) = 16.968, p = .10$ . Also, based on the other fit indices, it seems clear that the measurement model fits well (CFI = .98; RMSEA < .04 with a 90% confidence interval of .00 to .08). Figure H describes all of the zero-order construct relations which are statistically significant at either the .01 or .05 levels. The correlation between error terms for concept mapping and explaining important science ideas was .26 ( $p < .05$ ). The correlation between error terms for concept mapping and making charts and tables was .19 ( $p < .05$ ). The correlation between error terms for journal writing in science and making predictions was .21 ( $p < .05$ ). As presented in Table 8, items show moderate to high statistically significant loadings with its latent factor.

Table 8

*Confirmatory Factor Analysis: Standardized Path Coefficients and Test Statistics for the Conceptual Press Latent Factor*

Latent factor and indicators	Standardized path coefficient	<i>z</i> value
<i>Conceptual Press</i>		
My teacher:		
• asks me to draw concept maps about my reading	.37	3.26
• asks me to explain important science ideas in my reading	.40	3.41
• encourages me to read many science books	.68	3.97
• asks me to write about my science projects in a journal	.39	3.82
• asks me to make predictions about my science reading	.32	3.26
• encourages me to make charts and tables during reading	.52	3.74
• wants me to read books to learn science ideas	.69	3.97

*Note.*  $\alpha = .74$ ; All *z* values were significant at .05 level (e.g., exceeding 1.96).

*Measurement model for autonomy support.* Again, the confirmatory factor model for autonomy support was imposed upon the covariance matrix (derived from the questionnaire items). When testing this model, the path to “My teacher encourages me to follow my own interests when I read in science,” was fixed at 1.00 and was not estimated. Fixing one indicator for each latent variable allows the model to be properly identified. The rest of the parameters of interest were left free to be estimated. After the initial model specification, I made one theoretically justifiable adjustment to covary two residuals based on results from the Lagrange Multiplier Test (LM). A covariance was included between the following residuals, “My teacher helps me to create my own personal goals for learning science” and “My teacher encourages me to figure out how my science reading is useful,” because these items reflect the aspect of autonomy support that pertains to creating personal relevancy during reading.

The final fit of this measurement model is described in Figure I.

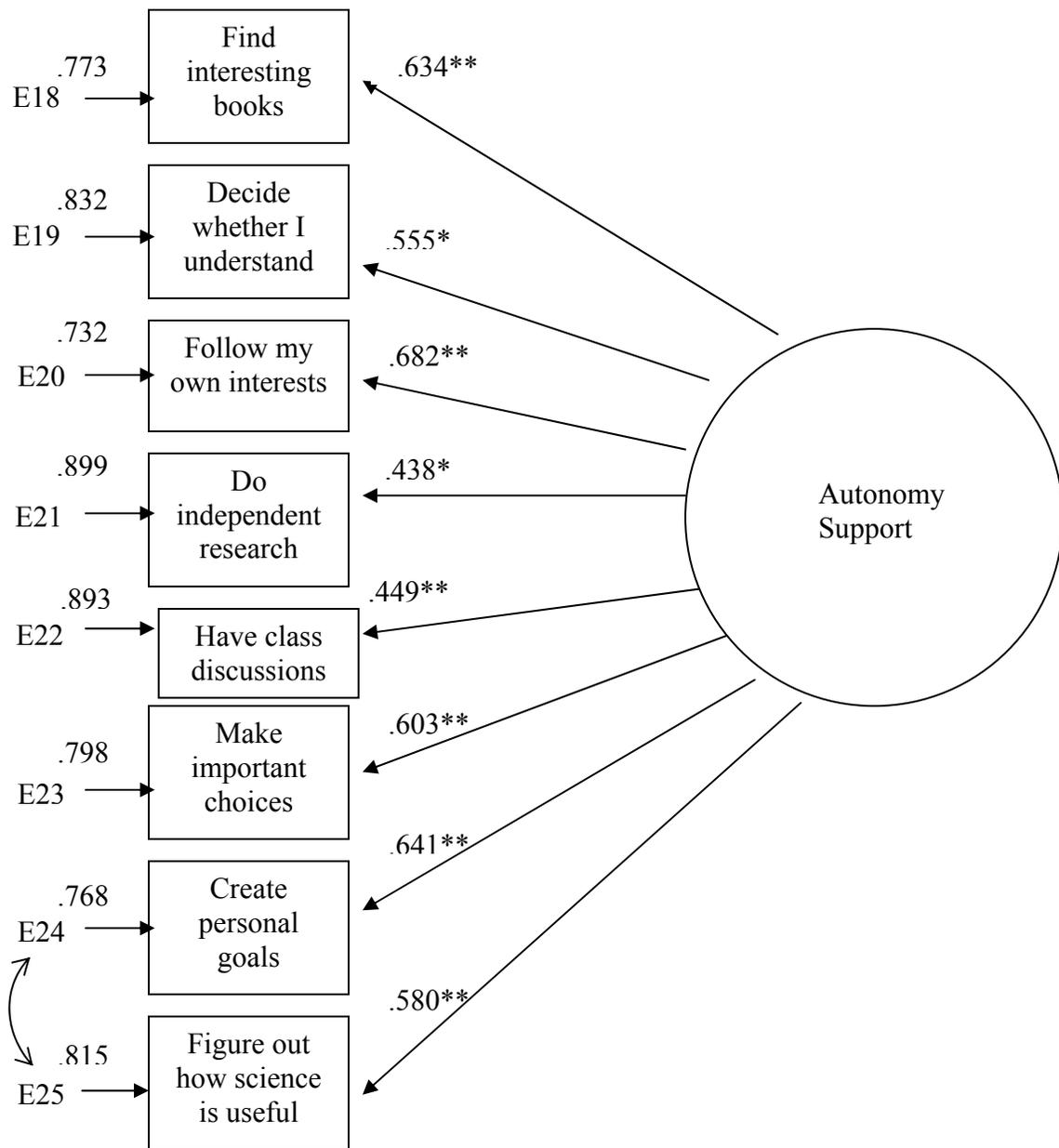


Figure 1. Measurement model of students' perceptions of their teacher's autonomy support.

$\chi^2(19, n = 244) = 21.163, p = .32 (ns)$ , Root Mean Square Error of Approximation (RMSEA) = .02, Comparative Fit Index (CFI) = .99. The correlation between error terms for creating personal goals and usefulness of science was .16\*; \* $p < .05$ ; \*\* $p < .01$ .

As indicated in Figure I, the measurement model's  $\chi^2$  and its associated non-significant  $p$ -value indicates that the model fits well  $\chi^2 (19, n = 244) = 21.163, p = .32$ . Based on the other aforementioned fit indices, it seems clear that the measurement model fits extremely well (CFI = .99; RMSEA < .02 with a 90% confidence interval of .00 to .06). Figure I indicates the zero-order construct relations which are statistically significant, as the test statistics ( $z$  value) of each factor loading was greater than 1.96. As presented in Table 9, items show statistically significant loadings with its latent factor. In sum, the measurement models provided a strong fit to the data and provided the basis for the structural models.

Table 9

*Confirmatory Factor Analysis: Standardized Path Coefficients and Test Statistics for the  
Autonomy Support Latent Factor*

Latent factor and indicators	Standardized path coefficient	<i>z</i> values
<i>Autonomy Support</i>		
My teacher:		
• helps me find interesting books about my science work	.63	8.09
• asks me to decide whether I understand what I read	.56	7.25
• encourages me to follow my own interests when I read	.68	8.10
• encourages me to do my own independent research	.44	5.86
• encourages class discussions about the reading	.45	6.00
• asks me to make important choices in science	.60	7.78
• helps me to create my own personal goals for learning science	.64	8.06
• encourages me to figure out how my science reading is useful	.58	7.38

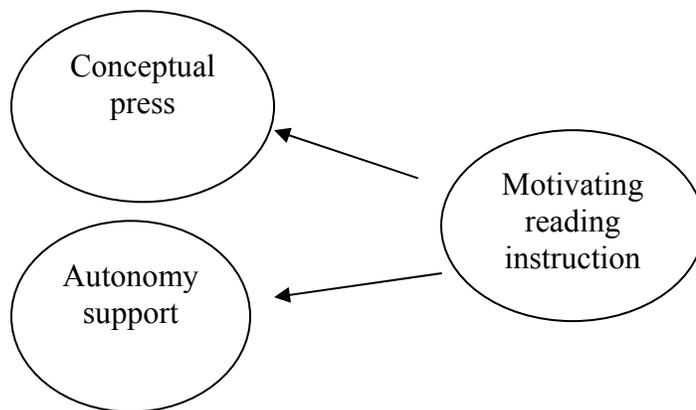
*Note.*  $\alpha = .80$ ; All *z* values were significant at .01 level (e.g., exceeding 3.92).

*Confirming a second-order factor structure for motivating reading instruction.* In the literature review, I defined and presented evidence for two sets of motivating practices that are conceptually distinct, but are co-occurring and mutually facilitating. The latent factor assumes that conceptual press and autonomy support are synchronized and integrated in the classroom. For example, when students are deeply immersed in understanding concepts, they naturally desire to choose topics that are interesting or compelling to them. When students create personal intentions to become experts in a topic, they may choose to read multiple books or explain their important ideas to others. In the same way, it seems reasonable to expect that students persist in reading moderately challenging books when they were given the latitude to choose the book. Therefore, I hypothesized a second-order factor structure in which motivating reading instruction was a latent variable whose indicators included conceptual press and autonomy support. In terms of a simple correlation, as expected, autonomy support and conceptual press were significantly correlated,  $r(243) = .68, p < .01$ , but relatively distinct.

The next step was to demonstrate that empirical methods supported a second-order factor structure, as hypothesized. Specifically, I investigated the factor structure of the set of items including both the autonomy support items and the conceptual press items. This was done by using a series of maximum-likelihood (ML) analyses. I conducted a test wherein I let each item load on one factor, then two factors (i.e., simple two-factor model), and a final test to confirm that a second-order factor structure, in fact, best explained the model to data relations. Comparisons among models were made using EQS's version of the Akaike Information Criterion (AIC; Akaike, 1987), for which

smaller values indicate a better fitting model. Model testing was also conducted using  $\chi^2$  difference tests for these models that had nested relations.

The simple two-factor model  $\chi^2$  and its associated significant  $p$  value indicated a poor fit to the data  $\chi^2 (87, n = 244) = 296.478, p < .001$ . The CFI was .75 and the RMSEA was equal to .10 with a 90% confidence interval of .08 to .11 and the AIC was 122.477. The hypothesized second-order factor model depicted in I was subsequently examined.



*Figure J.* Hypothesized second-order factor model of motivating reading instruction, consisting of the latent indicators, conceptual press and autonomy support.

The hypothesized second-order factor model had a significant improvement in fit over the model with lower dimensionalities. The results showed  $\chi^2 (86, n = 244) = 115.595, p = .02, CFI = .97, RMSEA = .04$  with a 90% confidence interval of .02 to .05. The AIC for this model was much smaller (-56.405) indicating a more parsimonious model. Further, the difference in chi square between the simple two-factor model and the hypothesized second-order factor measurement model showed that the second-order model was significantly different from the simple two-factor model,  $\Delta \chi^2 (1) = 180.883, p$

< .001. A one-factor model was also tested and had a slightly worse fit to the data (CFI = .96; RMSEA = .04 with a 90% confidence interval of .02 to .06; AIC = -56.154). As was theoretically hypothesized, the second-order factor model, with statistically significant construct loadings (.96, conceptual press and .99, autonomy support), empirically supported the best solution to the data and was used in subsequent structure equation modeling.

#### *A Test of the Hypothesized Structural Model*

In the second major phase of analysis, a structural model of theoretical importance was imposed upon the measurement model. Recall that the hypothesized model contained a latent construct, motivating reading instruction, which included students' perception of their teacher's conceptual press and students' perception of their teacher's provision of autonomy support. In the following section, I describe the observed variables in the hypothesized model.

*Observed variables in the hypothesized model.* As indicated in the literature review, engaged reading is a complex composite of affective, behavioral and cognitive qualities of reading. Therefore, measures of affect (reading motivation), behavior (amount and breadth of science reading), and cognitive (strategic reading and reading efficacy) were combined to form a single, observed variable to represent the theoretical premise of this study. That is, there are multiple components of engaged reading that are distinguishable but significantly associated. As expected in this study, the three constituents of engaged reading were significantly correlated. Reading motivation was significantly correlated with amount and breadth of science reading,  $r(243) = .21, p < .01$  and with strategic reading,  $r(243) = .20, p < .01$ . Amount and breadth of science

reading was also significantly correlated with strategic reading,  $r(243) = .20, p < .01$ . However, as also expected, these correlations were low because of the distinctiveness of each of the multidimensional processes. In order to capture the distinctiveness of each variable in the multidimensional construct, it was important that engaged reading be an observed variable. If engagement was represented as a latent trait, the construct would be restricted into a single dimension of shared variance among indicators and lose its theoretical multidimensional qualities. Therefore, to express the full range of variability explained by the three constituents of engaged reading, and not their shared variance, I formed a composite consisting of the sum of the three constructs, after the scores were standardized to the same scale.

In the hypothesized model, the exogenous variable of conceptual learning from text was an observed variable, as was the control variable of prior knowledge. Recall that these were observed scores from students' writing on a topic and coded on an 8-level knowledge rubric. As expected in this study, prior knowledge was significantly correlated with conceptual learning from text  $r(243) = .52, p < .01$ . Therefore, the structural models included a direct path from prior knowledge to conceptual learning from text to serve as a control variable.

*Testing the hypothesized model.* Considered in isolation, the hypothesized indirect effects structural model of conceptual learning from text fit the data well (see Figure K) as indicated by a non-significant  $\chi^2(130, n = 244) = 153.724, p = .08$  and by both a CFI of .98 and a RMSEA of .03 with a 90% confidence interval of .00 to .04.

Several relations in this model are worth noting. For instance, the standardized regression coefficient between motivating reading instruction and engaged reading was

.24, and the standardized coefficient between engaged reading and conceptual learning from text was .29. Both were statistically significant ( $p < .01$ ) and in the expected direction. When students' perceived reading instruction to be motivating they reported and demonstrated high engaged reading, which in turn was related to high conceptual learning from text.

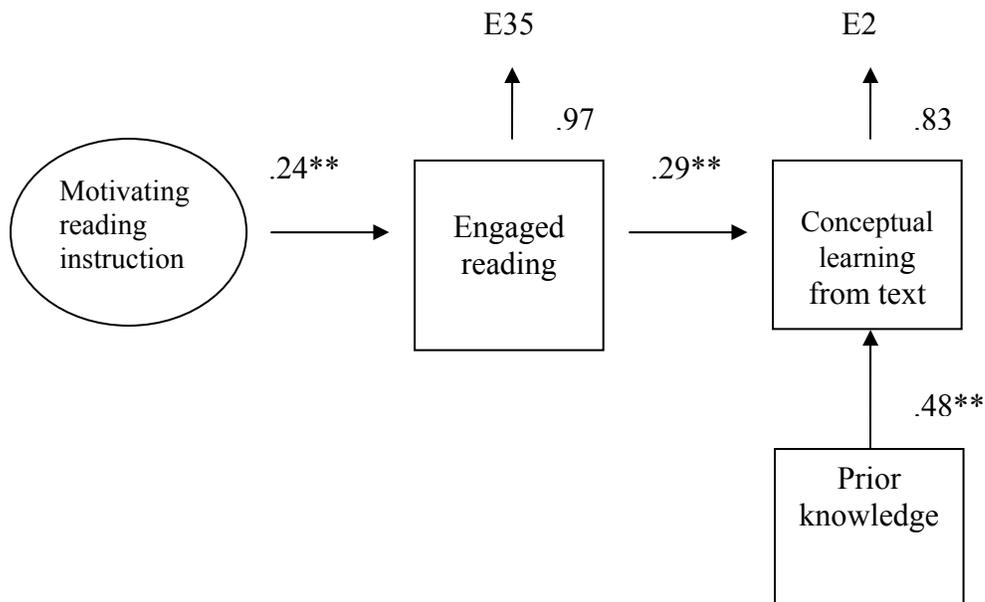


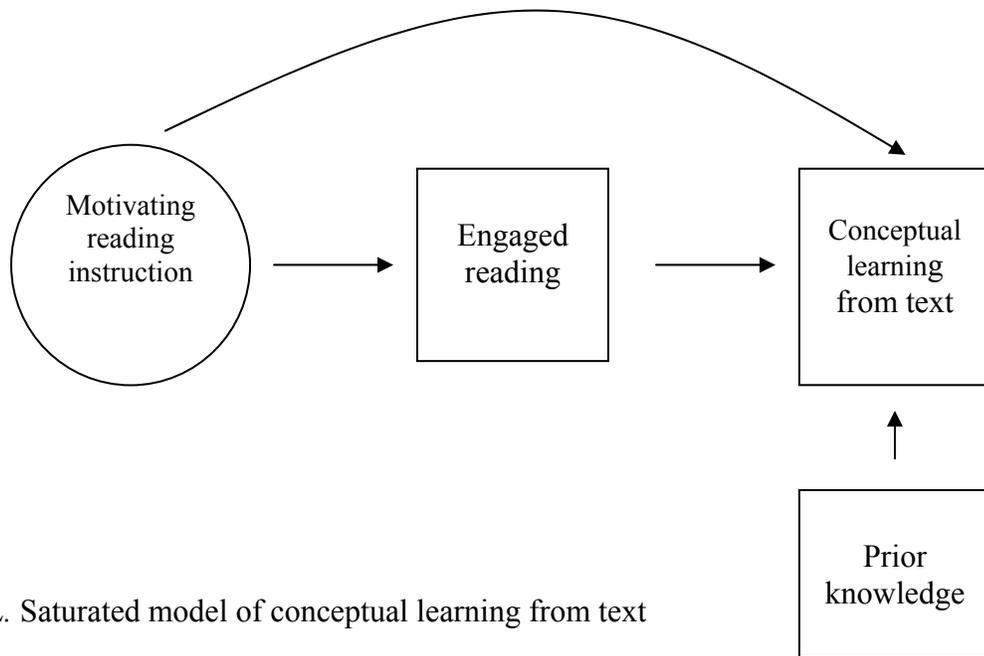
Figure K. Hypothesized indirect effects model;  $\chi^2 (130, n = 244) = 153.724, p = .08,$   
 CFI = .98, RMSEA = .03 (90% confidence interval = .00 to .04); \*\* $p < .01$ .

### Comparing Alternative Models

When using SEM, it is important to recognize that a given model represents a tentative representation of the data. Therefore, it is judicious to compare alternative competing models. As mentioned previously, models that are not nested cannot be directly compared statistically. Therefore, model comparison is conducted by positing a nested ordering of models in which the parameter estimates for a more restrictive model are a proper subset of those in a more general saturated model (Bentler, 1997). For the

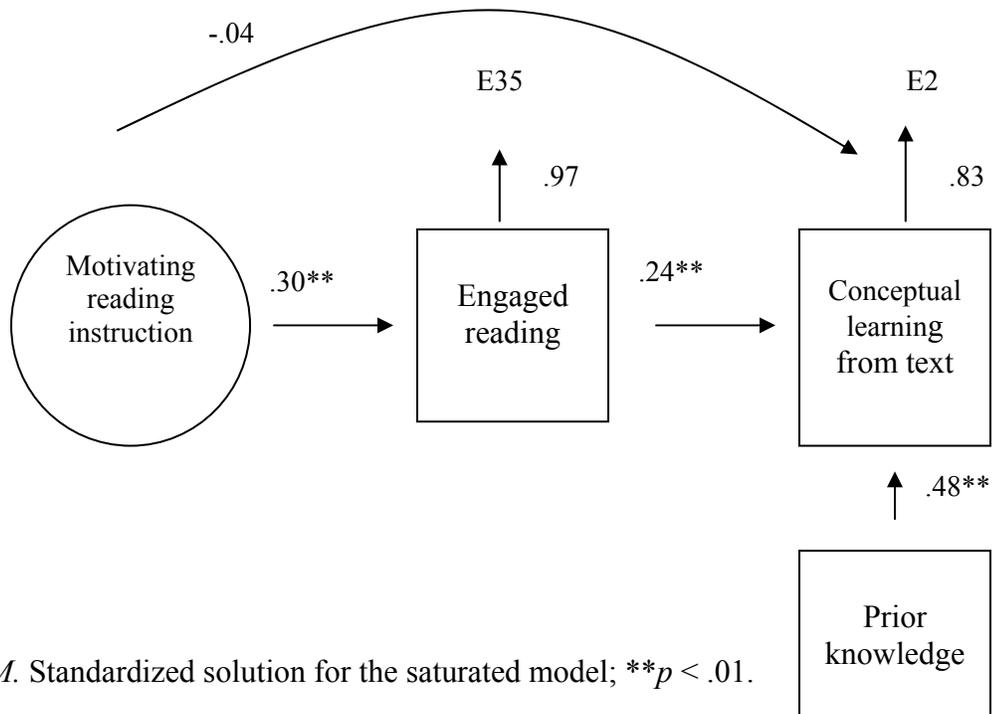
comparison in this study, I examined two competing theoretical models against a saturated model. Since the models of comparison were nested within the general saturated model, each model could be separately tested by estimating the difference in chi square ( $\Delta\chi^2$ ) values with the degrees of freedom. Since the saturated model necessarily has the best fit because it is the least constrained, models that are not statistically different from the saturated model indicate good fitting models. A second way to compare the alternative models involves the issue of statistical parsimony. Statistical parsimony is not always dependent upon the number of constructs contained in the model; thus, a more "complex-looking" model may actually be more statistically parsimonious due to the relation among its parameters. Therefore, the Akaike Information Criterion (AIC; Akaike, 1987) is a particularly useful index that measures relative parsimony between models that differ in the number of parameters. The smaller the AIC value is, the better the structural model fits the data.

Consider first the most saturated model of the three, which allows for both direct and indirect effects between motivating reading instruction and conceptual learning from text. This model is represented in Figure L.



*Figure L.* Saturated model of conceptual learning from text

This model fits very well because it is the least constrained in its structure. The  $\chi^2$  for 129 degrees of freedom with a sample size of 244 equals 153.187 with a non-significant  $p$  value that equals .07. The CFI equals .98 and the RMSEA equals .03 with a 90% confidence interval ranging from .00 to .04. Figure M presents the standardized solution paths in the saturated model.



In summary, of four paths specified in this model, three were found to be statistically significant. As expected, the standardized regression coefficient between motivating reading instruction and conceptual learning from text was  $-.044$  and was not significant. The standardized regression coefficient between motivating reading instruction and engaged reading was  $.30$  ( $p < .01$ ). The standardized regression coefficient between engaged reading and conceptual learning from text was  $.24$  ( $p < .01$ ).

The standardized regression coefficient between the control variable, prior knowledge, and the outcome variable, conceptual learning from text was .48 ( $p < .01$ ).

As mentioned previously, the two alternative structural models were nested within the saturated model and thus could be compared in order to determine which model offered a better fit to the data. One alternative model was the direct effects model, which indicated direct effects between motivating reading instruction and conceptual learning from text as well as direct effects between engaged reading and conceptual learning from text. Examination of the direct effects model revealed that the fit was poor by all recent standards, indicating that severing the tie between motivating reading instruction and engaged reading caused a statistically significant decrement in model fit relative to the saturated model ( $\Delta\chi^2 = 268.051, \Delta df = 1, p < .01$ ). The decrease in goodness of fit (CFI) from .99 for the saturated model to .70 for the direct effects model was substantial. Also note that the AIC for the direct effects model was 161.238 whereas the AIC for the saturated model was substantially smaller -104.813.

When comparing the fit differences between the hypothesized indirect effects structural model and the full saturated model, note that the hypothesized model did not cause a statistically significant decrement in fit ( $\Delta\chi^2 = .537, \Delta df = 1, ns$ ). The fit indices were good as discussed previously. Further, the AIC for this model was -106.276, which is smaller than the saturated model. Recall that the AIC value takes into consideration both the goodness of fit and the number of parameters estimated, with lower scores indicating better fit. For this reason, the hypothesized indirect effects model was considered the better representation of the data in this study. A summary of all model comparison fit indices is presented in Table 10.

Table 10

*Model Fit Statistics*

<i>Model</i>	$\chi^2$	<i>df</i>	<i>p</i>	CFI	RMSEA	(90% CI)	AIC
Saturated	153.187	129	.07	.98	.03	(.00, .04)	-104.813
Indirect effects	153.724	130	.08	.98	.03	(.00, .04)	-106.276
Direct effects	421.238	130	.001	.70	.09	(.09, .11)	161.238

*Note.* Chi square ( $\chi^2$ ); Degrees of freedom (*df*); Probability value (*p*); Comparative fit index (CFI); Root mean square error of approximation (RMSEA); Confidence interval (CI); Akaike information criterion (AIC).

To elucidate further the difference between the saturated model and the indirect effects model, consider the standardized direct and indirect effects from both models as shown in Table 11. Immediately noticeable is that, by dropping the path from motivating reading instruction to conceptual learning from text, no standardized relation changes by more than a few hundredths. The path from motivating reading instruction to conceptual learning from text in the saturated model was negative .04, whereas the zero-order correlation of these variables did not depart from zero. Thus, it seems reasonable to infer that there was an indirect effect of motivating reading instruction on conceptual learning from text through engaged reading. This is treated in the Discussion.

Table 11

*Decomposition of Standardized Effects for Structural Paths*

Path	Direct effect	Indirect effect	Total effect
<i>Indirect effects Model</i>			
DV: Conceptual learning from text			
Motivating reading instruction	0	.069*	.069*
Engaged reading	.290**	0	.290**
Prior knowledge	.478**	0	.478**
DV: Engaged reading			
Motivating reading instruction	.238**	0	.238**
<i>Saturated Model</i>			
DV: Conceptual learning from text			
Motivating reading instruction	-.044	.071*	.028
Engaged reading	.299**	0	.299**
Prior knowledge	.479**	0	.479**
DV: Engaged reading			
Motivating reading instruction	.238**	0	.238**

*Note.* The decomposition of effects was estimated on the basis of standardized path coefficients between each paired relation as a result of structural equation modeling; Total effect is a summation of direct and indirect effects. \* $p < .05$ ; \*\* $p < .01$ .

## Chapter V

### DISCUSSION

The purpose of this study was to test a model of the relations among motivating reading instruction in the domain of science, engaged reading, and conceptual learning from text. Prior knowledge was a control variable. Based on a self-process model of motivation (Connell & Wellborn, 1990), it was hypothesized that as students' perceived motivating reading instruction to be occurring, engaged reading would increase; and engagement in reading, in turn, would increase students' conceptual learning from text. Results of the present study provided support for the hypothesized model. The proposed indirect effects model was found to fit well with the data, and the estimated coefficients were all statistically significant. Thus, according to the theoretical model guiding this work, as children's perceptions of their teachers' support for autonomy and conceptual press during reading instruction in the domain of science increased, their reading engagement increased which, in turn, increased their conceptual learning from text.

There were important reasons to study fourth- and fifth-grade students' conceptual learning from expository text in the knowledge domain of science. First, there exist limited studies focusing on student learning from expository text in the context of science. Whereas many studies have focused on particular attributes of expository text across domains (i.e., refutational text, Guzzetti & Hynd, 1998), few have looked at how motivating teaching practices, particularly in the domain of science, foster conceptual learning from science-related texts and trade books (see Guthrie et al., 2004a, for exceptions).

Whereas many science educators place the role of text as subordinate to other inquiry science methods, such as experimentation (Linn et al., 2000), empirical evidence indicates that experimentation is necessary, but not sufficient, for growth in conceptual knowledge. In fact, one does not simply supplant the other. For example, evidence indicates instructional practices that support both the reading of multiple expository science texts and the use of experimentation and hands-on methods result in higher conceptual learning from text (Guthrie et al., 2004). It was particularly important to study other instructional practices that foster conceptual learning from expository text in the science domain. In this study, I focused on students' perceptions of their teachers' autonomy support and conceptual press in science class.

These results are noteworthy in several respects. First, many studies, especially in the domain of reading, have demonstrated evidence of successful teaching practices or programs fostering comprehension outcomes (Brown et al., 1997; Pressley, et al., 1992; Rosenshine & Meister, 1994; Stevens & Slavin, 1995; Williams et al., 2002). For example, Williams and her colleagues demonstrated evidence of a successful intervention program to help students identify story themes during reading. Also, Stevens and Slavin reported on the benefits of collaborative learning on reading comprehension. Although these studies featured some motivating practices, they did not consider reading engagement as a variable of study, but rather posited a direct effect between instruction and comprehension.

In psychological research, it is important to determine not simply that a relation exists, but *why* it exists. By studying reading engagement, we are better able to explain the relation between motivating practices in the classroom and academic outcomes

because it is the self-process mechanism which links the two (Connell & Wellborn, 1990). The study of engagement offers a more complete theoretical explanation of the psychology of student learning. This study extended the findings of classroom research that connect context with outcomes by adding an engagement variable and, thereby, more explicitly explaining the role of self-processes in academic outcomes.

Second, studies of the self-process model of motivation have focused on social contexts to study self-process effects on engagement (Furrer & Skinner, 2003; Skinner et al., 1990). However, the generalizability of results has been limited due to the use of single indicators or single constructs to describe the classroom context. More elaborated measures of the classroom context would help to generalize the results of these studies. In the present dissertation study, I extended the findings of previous work on the self-process model of motivation by examining a composite of two sets of motivating practices, conceptual press and autonomy support, both of which had multiple indicators with the item breadth to depict students' perceptions of their instruction under a more comprehensive lens.

In a similar vein, many investigators study motivation as a characteristic of a specific task as opposed to a stable or enduring process (Cordova & Lepper, 1996; Reeve et al., 2003; Reynolds & Symons, 2001). For example, Cordova and Lepper conducted an experiment in which they gave students in the experimental condition various activity-related choices while playing a computer game. They measured students' enjoyment, perceived competence, and task involvement and found these characteristics to be significantly higher among students in the motivationally embellished conditions. While it is important to study student motivation and engagement from a situationally-sensitive

perspective, this dissertation study extended the findings of the Cordova and Lepper study by expanding the definition and measurement of motivation and engagement. In this study, I examined the role of motivation beyond a single task to a more generalized effect. That is, I measured students' general motivation for reading, wide and frequent reading in the domain of science, and cognitive strategy use over a 2-day period for a complex task. These indicators represented a generalized construct of reading engagement.

Third, many studies of motivation have demonstrated significant effects on affective or emotional outcomes (Csikszentmihalyi et al., 1993; Miller & Meece, 1991; Turner, 1995; Turner et al., 2002). For example, significant relations have been found between autonomy support and affective outcomes, such as intrinsic motivation (Zuckerman et al., 1978) and a sense of enjoyment and vitality (Nix et al., 1999). Also, results of studies using conceptual press as a motivating practice have shown that students report positive affect, such as pride, increased effort, and desire to work hard (Miller & Meece, 1999; Turner & Meyer, 2004). While it is important to understand the effects of instruction on students' affect and emotion, it is also important to study instruction and engagement with relation to cognitive outcomes. This dissertation study expanded the findings of this line of work on motivation by including a complex cognitive outcome variable, in addition to engagement variables.

Finally, many qualitative studies of reading engagement and reading comprehension have pointed to important practices for teachers to utilize in their classrooms (Dolezal et al., 2003; Hacker & Tenent, 2002; Many, 1996). However, these studies have not discriminated between significant and insignificant practices for

fostering engagement, nor was a criterion for choosing best practices established.

Successful quantitative intervention programs have utilized some motivating practices in instruction (Scardamalia et al., 1994; Guthrie, Van Meter et al., 1998), however these studies have not specifically isolated the practices in their research to determine specific effects on engagement and conceptual learning. One purpose of this investigation was to expand on the findings of those qualitative and quantitative studies by empirically testing a smaller set of motivating practices to determine its relations with reading engagement and comprehension outcomes. Below I expound on each of these four points.

#### *Reading Engagement as a Potential Pathway in the Study of Comprehension*

A major goal of this study was to explore a promising mechanism through which motivating reading instruction could make a substantial difference on students' conceptual learning from text. The findings herein suggest that reading engagement is one likely conduit. A substantial majority of studies on text comprehension instruction have examined instruction's direct influences on reading achievement (Palincsar & Brown, 1984; Pearson & Fielding, 1991; Pressley, El-Dinary et al., 1992; Stevens & Slavin, 1995; Williams et al., 2002). However these studies did not specifically measure reading engagement.

In my view, a number of instructional interventions described in the aforementioned text comprehension studies have endorsed elements of motivating reading instruction which might have been related to reading engagement if the construct had been measured. For example, in a two-year long reading comprehension study of elementary students, Stevens and Slavin (1995) found that instruction centered on cooperative learning, personal meaningfulness, and integration of reading and writing

skills had significant benefits on students' reading comprehension for both average and mainstreamed struggling readers. Although students were asked a question about how much they liked their school subjects, reading engagement was not measured in a comprehensive manner. Thus, reading attitudes were non-significant and the study concluded that instruction influenced comprehension processes directly. I expect that if reading engagement had been measured more comprehensively, indirect effects of instruction through engagement may have supplanted these direct effects. As a result, we might have a better theoretical understanding of the mechanisms at work in influencing academic outcomes.

We have long known that cognitive processes have direct effects on reading comprehension processes. For example, multiple studies have found significant evidence that cognitive strategy use, such as making inferences, influences reading comprehension directly (Rosenshine & Meister, 1994). However, it is also evident that when we increase a student's reading engagement, his or her cognitive, behavioral and affective systems become energized. Thus, reading engagement turns out to be an enabler or facilitator of conceptual learning from text. Now that we have entered the *era of engaged learning* (see Alexander and Fox, 2004), recent studies are showing a more complete account of achievement outcomes (Reeve et al., 2003; Wigfield, Perencevich, Tonks, & Guthrie, 2003) because they are explaining effects with reference to students' self-processes, which is the mechanism through which social contexts influence academic outcomes. This study extended the findings of classroom research that connects context with outcomes by adding an engagement variable and, thereby, giving a more complete theoretical account of the role of self-processes in academic outcomes.

*Extending the Results of Previous Studies: Generalized Effects*

*Generalizing the effects of social contexts on engagement.* This dissertation study extends the role of the self-process model of motivation in classroom research. In some studies of the self-process model of motivation, the social context has been measured with few indicators (e.g., Furrer & Skinner, 2003; Skinner et al. 1990). For example, Skinner and her colleagues (1990) studied teacher contingency and involvement. Contingency referred to whether the teacher provided clear and consistent expectations and feedback. Involvement referred to whether the teacher showed positive interest in knowing the children and considering their opinions when making decisions. It was hypothesized that engagement in learning would be a mediator between perceived control and academic outcomes. In a path analysis, Skinner showed that the social context was significantly associated with students' perceived control which, in turn, was associated with students' engagement. It would be important to replicate Skinner's findings, however, because contingency and involvement were measured with two specific indicators to represent an "engaging" social context. Such specificity may lead to a limited view of "engaging context" and thus, may not optimally predict the multifaceted nature of engagement.

In this dissertation study, I built on the work of Skinner and attempted to define and measure two broader aspects of the instructional context. I also used a diverse set of items to represent two sets of motivating practices to represent the social context of instruction in reading.

*Generalizing the contribution of reading engagement.* Some studies have measured student engagement as a situationally-dependent outcome of a task or activity.

For example, Csikzentmihalyi and his colleagues (1993) used an experience sampling method (ESM) via a personal beeper to gauge information about individuals' participation and involvement in activities. They asked the individuals to report on their affective and behavioral engagement at certain moments throughout the course of the study. In another study, Iyengar and Lepper (1999) examined the effects of choice on students' motivation in the context of completing a specific task for a specific purpose (i.e., completing a computer anagram task). Motivation was measured through student reports of their general liking of the task and the performance indicator of whether they chose to participate in the task during free time.

Other studies have also measured students' engagement with regard to task involvement, participation, or short-term enjoyment (see Fredericks et al., 2004, for a review). Not only is it important to understand engagement on a specific task, but it is also important to study engagement as a more general, enduring characteristic. This dissertation study extends our knowledge about reading engagement as a more general, long-term characteristic. The measurement of engagement in this study was specific to reading in the science domain, but more general than one situationally-bounded reading task.

### *Predicting Affective and Cognitive Outcomes*

Many studies of motivation have demonstrated significant effects on affective and emotional outcomes (Csikszentmihalyi et al., 1993; Miller & Meece, 1991; Turner, 1995; Turner et al., 2002). Turner (1995) found that when teachers provided activities in which children were afforded a certain degree of freedom and responsibility (e.g., they chose which story to read and whether to write or draw), student intrinsic motivation was

relatively high. In contrast, intrinsic motivation declined when teachers provided little choice, challenge, or opportunity to exercise alternatives in learning activities. Further, Miller and Meece (1999) studied third graders' reactions to and preferences for challenging reading tasks. During a year-long observation/interview study with 24 students, the researchers identified literacy tasks as high or low challenge. High challenge activities were ones that lasted over a period of days or weeks and encouraged collaboration and extended writing as opposed to simple question-answer or fill-in-the-blank assignments. Results indicated that students who were frequently exposed to high challenge tasks reported positive affect, such as pride, increased effort, and desire to work hard. In contrast, students who were minimally exposed to challenging instruction reported low competence beliefs when faced with a challenging task. While it is important to understand the effects of instruction on students' affect and emotion, it is also important to study instruction and engagement with relation to cognitive outcomes.

This dissertation study builds on the findings of the Turner and Miller and Meece studies by adding a cognitive outcome variable. The results of this study indicated that students who perceived their teachers to be supporting conceptual press (i.e., concept mapping, explaining important ideas, reading multiple books) and supporting autonomy (i.e., giving students important choices, encouraging students to create personal goals for learning) were more engaged in reading. In turn, engagement in reading was significantly associated with conceptual learning from text.

### *Identifying Best Practices*

Many qualitative studies of reading engagement and reading comprehension point to important practices for teachers to utilize in their classrooms (Dolezal et al., 2003;

Hacker & Tenent, 2002; Many, 1996). For example, in a qualitative study of reading instruction, Dolezal and her colleagues identified some 100 practices that supported motivation in reading, including (a) high expectations, (b) appropriate pacing, (c) adult volunteering, (d) connecting reading and writing across the curriculum, and (e) teacher encouragement. Similarly, in a qualitative study of reciprocal teaching, Hacker and Tenent also identified several practices that supported reading comprehension, including (a) modeling and scaffolding reading strategy use for multiple strategies, such as, questioning, summarizing, and monitoring; (b) use of rich social dialogue; and (c) integrating reading and writing. However, these studies did not differentiate between those practices that might be essential and those that might be less important. In a similar vein, successful quantitative intervention programs have utilized sets of motivating practices (Scardamalia et al., 1994; Guthrie, Van Meter et al., 1998), but have not isolated the practices to discern which ones may have particular benefits on student engagement.

One purpose of this investigation was to expand the findings from those qualitative and quantitative studies by empirically testing a smaller set of motivating practices to determine its relations with reading engagement. Findings from this dissertation study indicated that autonomy support and conceptual press are two sets of motivating practices which are important for fostering reading engagement among fourth- and fifth-grade students.

#### *Rationale for Measures*

*Measuring conceptual learning from text.* A plethora of tests exists to measure reading comprehension skills, such as The Woodcock Johnson standardized test, The Gates-MacGinitie standardized test, error-detection tests, miscue analysis, and cloze

procedure assessments. In this dissertation, it was important to distinguish reading comprehension from conceptual learning from text. The aforementioned reading comprehension measures are focused, requiring short paragraph or sentence-level comprehension. Often they require a multiple choice or short answer response. In this study, one goal was to assess students' ability to gain conceptual knowledge after reading a complex text over a two-day period. Reading a longer text over a longer period of time required students to establish purposes for reading, use their cognitive strategies, and construct meaning in a multi-tiered approach. Also, it was important that this measure of conceptual learning from text mimic classroom reading of typical fourth-and fifth-grade classes.

For this performance assessment, students read relevant sections in multiple chapter expository text about ponds and deserts. Students wrote a pre- and post-reading essay about the similarities and differences of the biomes. In the literature review, I defined conceptual knowledge in a domain as including: (a) prior knowledge of the domain; (b) a large volume and coherence of basic facts (e.g., structures and features of a concept); (c) networks of relational and hierarchical structuring of the facts; (d) a well-defined understanding of the principled abstractions that govern and explain the concept; and (e) an awareness of multiple viewpoints and models from the domain. Thus, conceptual learning from text involves knowledge of facts, relations, and systems that merge into a set of principles that underlie a domain of knowledge. It differs from simple reading comprehension in that it reflects the new information acquired from reading text (Guthrie & Scafiddi, 2004).

Consistent with this view of conceptual learning from text, the measure used in this dissertation study required students to construct new knowledge about a topic. By using a rubric to code students' conceptual learning from text, I was able to distinguish levels of conceptual learning. In my view, if a student recalls an abundance of facts from an extended text reading, he or she is not necessarily showing evidence of high conceptual learning from text. Thus, the expression of a quantity of facts isolated from principles has a ceiling score. Embedded in the rubric are "qualitative" shifts in knowledge growth. That is, as a student advanced to a higher level of knowledge, not only was factual recall expressed, but also, relations and principled knowledge was demonstrated. For this study, rather than merely counting a number of propositions, the scoring rubric enabled me to distinguish "quantity" of facts from "quality" of conceptual learning from text. In sum, to be predicted by a multi-faceted construct of reading engagement composed of affective, behavioral, and cognitive components, the performance assessment used in this study was necessarily complex. The findings from this dissertation study indicated that conceptual learning from text was predicted by a multifaceted expression of reading engagement.

*Measuring reading engagement.* In the past, researchers might have measured on-task behavior or homework completion as indicators of engagement (Lee & Smith, 1993; Finn & Rock, 1997). A potential limitation in using a single technique to assess engagement, such as observing students to identify on-task behaviors, is that one could potentially misinterpret students' facial expressions and not fully capture important engagement processes. Recent research points to the importance of expanding the definition and measurement of engagement to include all of its components (Connell &

Wellborn, 1990; Fredericks et al., 2004). These include the affective, behavioral, and cognitive components of engagement (Fredericks et al., 2004; Guthrie, Wigfield, Barbosa et al., 2004).

According to the definition, engaged readers establish personal intentions for reading, use cognitive strategies to intentionally seek knowledge, express confidence about reading, and explore multiple texts to extend their conceptual knowledge of the domain (Guthrie et al., 2004a). In this study, all of these aspects of engaged reading were measured. Participants reported on their efficacy and intrinsic motivations for reading, used search and summarizing skills to gain knowledge from a complex text, and reported on the amount and breadth of their reading in the science domain. All of these affective, cognitive, and behavioral manifestations of reading engagement were considered important in predicting conceptual learning from text. This study also included both performance and self-report measures to capture the construct of reading engagement in a more meaningful manner. A combination of both types of measures may have depicted the complexity of engaged reading better than either measure alone.

Many previous studies have shown strong relations between the constituents of engaged reading, which include reading motivation, amount and breadth of reading, and strategic reading (Guthrie, Wigfield, Metsala, & Cox, 1999; Pintrich & DeGroot, 1990; Tonks et al., 2004). For example, Cox and Guthrie found significant correlations between reading amount and breadth in grades three and five and between several aspects of motivation, including curiosity, involvement, preference for challenge, and reading efficacy. Reading motivation and strategic reading have also been shown to have significant correlations in multiple studies (de Sousa & Oakhill, 1996; Reynolds &

Symons, 2001). Lastly, wide and frequent reading has been shown to be significantly correlated with strategic reading (Cox & Guthrie, 2001a, Wigfield et al., 2004). This dissertation study confirmed the findings from previous studies showing evidence of relations among the components of engaged reading for upper elementary students. Like previous studies, the findings from this dissertation study indicated that the constituents of reading engagement were significantly correlated.

The findings in this study also extend the existing literature base about the effects of different aspects of reading engagement on reading outcomes (Baker & Wigfield, 1999; Cipelewski & Stanovich, 1992; Cunningham & Stanovich, 1991; Gottfried, 1990). For example, it has been shown that reading motivation is associated with reading outcomes in general, such as grades, recall of reading passages, standardized achievement tests, and reading comprehension tests (Baker & Wigfield, 1999; Gottfried, 1990; Guthrie, Wigfield, Barbosa et al., 2004; Schraw & Dennison, 1994; Wade, Buxton, & Kelly, 1999). Also, reading comprehension and conceptual learning from text has been substantially predicted by amount and breadth of reading (Anderson et al., 1988; Cipelewski & Stanovich, 1992; Cunningham & Stanovich, 1991; Greaney, 1980; Taylor et al., 1990). In addition, a number of empirical studies on strategic reading have shown its important benefits on comprehension and conceptual learning from text (National Reading Panel, 2000; Pressley et al., 1992; Rosenshine & Meister, 1994; Rosenshine, Meister, & Chapman, 1996). This study builds on the results from previous work connecting engagement with conceptual learning from text. In this dissertation study, a multifaceted representation of reading engagement had significant associations with

conceptual learning from text. By combining aspects of engaged reading, I formed a more robust multi-faceted construct that was significantly related to the outcome variable.

*Measuring motivating reading instruction.* Many existing measures of instruction have relied on teacher reports of their own instruction or ratings by outside observers (Dolezal et al., 2003; Turner et al., 1998). However, because this study's theoretical framework centered on the self-system, it was important to understand potential motivating practices from students' perspectives. This methodological approach centers on the notion that students are constantly constructing beliefs about themselves (Eccles et al., 1998) and beliefs about their environment by interacting in their social contexts (Connell & Wellborn, 1990; Skinner & Belmont, 1993).

Some instructional measures of motivational support (e.g., Midgley's, 2002, Classroom Goal Structure Scale) have focused on generic goals rather than actual practice in a domain-specific content area. A potential weakness of a goal-type measure is that items tend to be vague and content-free. For example, a teacher may value learning as opposed to performance as a goal of instruction, however, he or she may not be fully equipped with knowledge about practices conducive to supporting a student's mastery versus performance orientation. For example, one learning goal item on the Classroom Goal Structure Scale is "In our class, the teacher tries to find out what each student wants to learn about." It is conceivable that a teacher asks students what they want to learn about but does not follow-up in practice. Just asking the question does not translate to the teacher actually allowing students to create their own goals for learning, nor does it necessarily mean that the teacher devises lessons based on student interest. While the

goal is worthy, in the end, it is actual practice that will inevitably change students' beliefs and perceptions about engagement and learning.

The questionnaire I developed for this study was specifically designed to describe domain-specific motivational practices. Despite evidence that teachers utilize these motivating practices in the classroom (Dolezal et al., 2003; Scardamalia et al., 1994), researchers have not specifically measured the extent to which students' perceived these practices to be occurring. One advantage of the student perception measure in this study is that it revealed important motivating practices in the domain of reading and thus provided a proximal indicator of the students' experiences. This study confirmed the findings of previous studies which suggest the use of student perception data to predict cognitive, behavioral, and affective outcomes. Indeed in this study, student perceptions of their teachers' support for conceptual press and autonomy support were significantly associated with multiple aspects of reading engagement.

*Using a latent factor of motivating reading instruction.* Researchers studying self-determination (e.g., Deci & Ryan, 1987) have long considered both competence and autonomy to be important contributors of student engagement processes. Ryan and Deci (2000) stated "for a high level of intrinsic motivation, people must experience satisfaction of the needs both for competence and autonomy" (p. 58). In this study, I suggested that when teachers use motivating practices, such as conceptual press and autonomy support, they would be facilitating important self-processes, which would, in turn, would spur students to engage. It was my contention that autonomy support and conceptual press are mutually supporting practices that are best manifested when they co-occur in instruction.

When students are deeply immersed in understanding concepts, they naturally desire to choose topics that are interesting or compelling to them. When students create personal intentions to become experts in a conceptual domain, they may choose to read multiple books or explain their important ideas. During different phases of conceptually pressing activities, students may need freedom to pursue their ideas either through reading texts or organizing their thoughts, or they may need latitude to ask questions of their peers and share their expertise with others. Conversely, when conceptual press is absent, choices, too, become superficial (see Stefanou et al., 2004 for a review of task versus cognitive autonomy support). Thus, tasks requiring lower level thinking are typically prescribed and constraint-laden. In this dissertation, I proposed that when the instruction context supports a mutual press for conceptual understanding and support for autonomy, reading engagement increases. The findings from this study indicated that a model with this hierarchical structure explained the data best. Motivating reading instruction, containing both conceptual press and autonomy support, was significantly associated with reading engagement.

In order to study the latent factor, it was necessary to establish definitions of conceptual press and autonomy support in a specific context. For example, in this study, I stressed the importance of meaningful and informed choices as one aspect of autonomy support (Stefanou et al., 2004). I agree with Reeve and his colleagues (2003) who noted “if the provision for choice is going to affect the experience of self-determination in intrinsic motivation, then it needs to be designed in such a way that increases internal locus and volition” (p.389). In this study, I suggested, too, that choice is not the only beneficial aspect of autonomy support in schools (see Guthrie et al., 2004b; Stefanou et

al., 2004; Turner et al., 1998). The findings from this dissertation supported the conclusion that when teachers give students opportunities to create personal goals, establish personal relevance and usefulness, and conduct independent research in the context of reading, they are also supporting student autonomy. This provided additional evidence suggesting that supporting autonomy in the classroom will help students to become self-determined learners (Deci, & Ryan, 1994).

Also, with regard to conceptual press, I proposed three concrete scaffolds that teachers could put in place to support reading engagement. When teachers establish ways for students to understand how concepts and facts integrate into a cohesive system, they are offering conceptual press. Further, when teachers create the context for students to explain important ideas, reorganize incoming text information, and use multiple sources to gain knowledge, they are supporting conceptual press (Cox & Guthrie, 2002). As Brown (1997) explained "one cannot expect students to invest intellectual curiosity and disciplined inquiry on trivia. There must be a challenge; there must be room to explore, to delve deeply, to understand at ever deepening levels of complexity" (p. 407). These types of motivational scaffolds may help students to "delve deeply."

Historically, researchers focused solely on the cognitive benefits of conceptual pressing instruction (Pressley et al., 1992; Rosenshine & Meister, 1994). And, indeed the research does indicate that conceptual press increases cognitive competencies (Heinze-Fry & Novak, 1990; Okebukola, 1990; Woloshyn, Paivio, & Pressley, 1994). However, this study underscores idea that conceptual press is not only cognitively beneficial, but it is also engaging (Turner & Meyer, 2004; Middleton & Midgley, 2002). Consistent with this idea, Csikszentmihalyi and his colleague (1993) studied various tasks that students

pursued throughout a day. They found that students reported clarity of purpose with strong concentration, alertness, and attention when faced with tasks that demanded deep thinking. Further, they suggested that students who experienced conceptual press reported feelings of intrinsic motivation, such as losing track of time or feeling “one” with the activity. In this dissertation study, I suggested that teachers who provided conceptually pressing activities would be supporting the multifaceted qualities of engagement. The results indicated that indeed these types of motivational scaffolds were significantly associated with reading engagement.

I suggest that the motivating practices discussed in this dissertation study may have long-lasting effects. This thinking is not unlike Mitchell’s (1993) work on interest in the classroom. He suggested that interest had two components: catch and hold. Catch activities represent the “bells and whistles” of instruction used to attract attention. Hold activities represent instruction that engages students meaningfully in academic tasks. The catch activities lead to a superficial level of engagement, according to Mitchell (1993), whereas the hold activities are ones that lead to deeper levels of engagement and perhaps promote all aspects of engagement, behavioral, affective, and cognitive. Drawing on this analogy, I contend that simple procedural choices absent from conceptually pressing activities represent a catch, whereas supporting the hold involves providing a context for engagement that includes student control over important academic decisions in a conceptual milieu.

#### *Limitations of this Study*

This study used structural equation modeling to compare alternative competing models explaining the relations among motivating reading instruction, engaged reading,

and conceptual learning from text. Although the present results provided support for the hypothesized model, some limitations should be taken into consideration when interpreting the findings. First, despite the strengths conferred by using SEM analyses, it must be reiterated that the data for the present study were cross-sectional and correlational and thus firm causal conclusions are not warranted. Causal conclusions could only be drawn with greater confidence if the current model was replicated with the use of longitudinal data.

A second limitation in this study was that some of the significant relations in the model were modest in magnitude. Other unmeasured factors may play a role in the prediction of engaged reading and conceptual learning from text. Skinner noted that “all three sets of self-system processes (i.e., autonomy, competence, and relatedness) must be maximized to produce optimal levels of engagement’ (p. 31). It is likely that other motivational support practices in the classroom also may be important predictors of student engagement, such as pedagogical caring (Wentzel, 1999; 2002) or relatedness (Furrer & Skinner, 2003), or the use of stimulating tasks as a motivational practice (Guthrie, Wigfield, Humenick et al., 2004). There is a need to understand which practices are necessary without which, engagement would not occur. What motivating practices initiate engagement? Which practices make up an engaging context that may lead to long-term engagement? These research questions are essential and worth pursuit.

Future studies should incorporate the full range of self-processes in the prediction of engagement and academic outcomes. For example, the power of the interpersonal relatedness between a teacher and his or her students cannot be dismissed or underestimated (Furrer & Skinner, 2003; Wentzel, 1999). Some educational research has

explored the influence of students' sense of belonging in their classrooms and school environments (Wentzel, 1999, 2002). Indeed, students who report a greater sense of belonging in the classroom tend to be the ones who demonstrate positive affect, behavior, and cognitive engagement (Furrer & Skinner, 2003). Future studies on the self-system processes in the context of school should incorporate all supports necessary to optimize the self-system, including, relatedness, competence, and autonomy.

This study measured classroom practice from the students' perspective. Future studies with in-class observations, videotape analyses, and triangulation methods might provide a more complete portrait of the contribution of motivating reading instruction to reading engagement and conceptual learning from text (see Turner & Meyer, 1999).

Although representative of the school district, the participants were predominately white, middle class students. As an important next step, the examination of the effects of autonomy support and conceptual press on reading engagement and conceptual learning from text should be studied in more diverse samples. In fact, for students of various socioeconomic statuses, who may feel marginalized by the system, these motivating practices may be an even more important source of reading engagement and conceptual learning from text.

Further, future studies should test whether this engagement model holds across age, gender, and achievement levels. For example, although fourth- and fifth-grade students represent a reasonably homogenous group, it would be important to examine whether the relations in the model differ as a function of age. It is reasonable to assume that the engagement model of reading in the domain of science is functional for both girls and boys however, this issue requires further analysis.

Perhaps most important, a direction for future research is to assess the long-term consequences of providing autonomy support and conceptual press in integrated instructional settings, such as reading in science in this study. Longitudinal research is needed to establish whether supporting students' choices and decision making in the context of reading in science and providing conceptually pressing instructional activities can help maintain students' engagement in reading expository texts in science, increase scientific knowledge gained from reading expository texts, and heighten interest in subsequent science studies.

## APPENDIX A

### Perceptions of Motivating Reading Instruction Survey (PMRIS)

#### Conceptual Press Items

1. My teacher encourages me to summarize when I read.
2. My teacher asks me to draw pictures about my reading.
3. My teacher asks me to read books that I can understand if I think about them.
4. My teacher asks me to find the supporting details for the main ideas when I read.
5. My teacher encourages me to ask myself questions when I read.
6. My teacher wants me to try to read books even though they are hard to understand.
7. We get most of our information from one textbook in science (reverse coded).
8. My teacher encourages me to keep trying even if the science work is hard.
9. In science, I take a lot of quizzes about the textbook.
10. My teacher uses many examples to explain concepts in science.
11. My teacher gives me big projects to do in science.
12. My teacher gives me the right amount of help when science is hard.
13. My teacher asks me to do science experiments.
14. My teacher asks me to draw concept maps about my science reading.
15. My teacher asks me to explain the important ideas in my science reading.
16. My teacher encourages me to read many different books in science.
17. My teacher encourages me to write about my science projects in a journal.
18. My teacher asks me to make predictions based on what I read in science.
19. In science, my teacher encourages me to make charts and tables while I read.

20. My teacher wants me to read books that help me learn new ideas in science.

#### Autonomy Support Items

21. My teacher wants me to choose books about science topics that I like to read.

22. My teacher helps me to make my own goals when I read.

23. My teacher asks me to express my own opinion about what I read.

24. In science, my teacher asks me to research topics I am interested in.

25. My teacher asks me to find interesting books about my science work.

26. My teacher asks me to decide whether I understand what I read in science.

27. My teacher encourages me to follow my own interests when I read in science.

28. In my class, we read the same science book together (reverse coded).

29. My teacher encourages me to do my own independent research in science.

30. My teacher encourages class discussions about the science reading.

31. My teacher asks me to make important choices in science.

32. My teacher tells me exactly how to do my science experiments (reverse coded).

33. My teacher helps me to choose science books that are meaningful.

34. My teacher helps me to create my own personal goals for learning science.

35. My teacher encourages me to figure out how my science reading is useful.

36. I help my teacher decide what topics to read about in science.

37. My teacher encourages me to do the same experiments as my classmates(reverse).

38. My teacher encourages me to work in my own way when I want to.

39. My teacher lets me write answers to science questions using my own words.

40. My teacher helps me to enjoy many interesting books in science.

Note. Student responses are *Never*, *Almost Never*, *Sometimes*, and *A lot*.

APPENDIX B

Principal Components Factor Analysis: Autonomy Support

	<i>Item</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
25	My teacher asks me to find interesting books about my science work.	.638	.365	-.011	-.147	.062
30	My teacher encourages class discussions about the science reading.	.620	-.127	-.021	.279	.118
26	My teacher asks me to decide whether I understand what I read in science.	.610	.196	.074	-.114	-.234
34	My teacher helps me to create my own personal goals for learning science.	.589	.264	.094	.313	-.095
35	My teacher encourages me to figure out how my science reading is useful.	.573	.217	.073	.299	.012
29	My teacher encourages me to do my own independent research in science.	.563	.009	.031	-.079	.442
27	My teacher encourages me to follow my own interests when I read in science.	.538	.474	.168	.031	-.057
31	My teacher asks me to make important choices in science.	.533	.155	.362	.047	-.002
24	In science, my teacher asks me to research topics I am interested in.	.412	.409	.318	-.137	.104
22	My teacher helps me to make my own goals when I read.	.398	.342	.340	.304	-.211
38	My teacher encourages me to work in my own way when I want to.	-.064	.758	.076	.053	-.026
36	I help my teacher decide what topics to read about in science.	.265	.571	-.289	.189	.059
21	My teacher wants me to choose books about science topics that I like to read.	.423	.544	.179	.016	.084
33	My teacher helps me to choose science books that are meaningful.	.414	.505	.013	.145	.190
40	My teacher helps me to enjoy many interesting books in science.	.256	.444	.418	.150	.100
39	My teacher lets me write answers to science questions using my own words.	-.054	-.048	.769	.133	-.122
23	My teacher asks me to express my own opinion about what I read.	.372	.138	.574	-.083	.325
37	My teacher encourages me to do the same experiments as my classmates (reverse).	.040	-.001	.138	.741	.066
32	My teacher tells me exactly how to do my science experiments (reverse coded).	.055	.145	-.032	.701	.060
28	In my class, we read the same science book together (reverse).	-.084	.103	-.008	.154	.816

APPENDIX C

Principal Components Factor Analysis: Conceptual Press (requesting 2-factors)

	<i>Item</i>	<i>Factor 1</i>	<i>Factor 2</i>
1	My teacher encourages me to summarize when I read.	.677	.114
8	My teacher encourages me to keep trying even if the science work is hard.	.657	-.053
6	My teacher wants me to try to read books even though they are hard to understand.	.590	.143
5	My teacher encourages me to ask myself questions when I read.	.569	.298
3	My teacher asks me to express my own opinion about what I read.	.554	.179
10	My teacher uses many examples to explain concepts in science.	.454	-.001
2	My teacher asks me to draw pictures about my reading.	.421	.338
4	My teacher asks me to find the supporting details for the main ideas when I read.	.395	.090
7	We get most of our information from one textbook in science (reverse coded).	.334	.061
9	In science, I take a lot of quizzes about the textbook.	.214	.141
19	In science, my teacher encourages me to make charts and tables while I read.	-.089	.684
17	My teacher encourages me to write about my science projects in a journal.	.016	.607
16	My teacher encourages me to read many different books in science.	.328	.557
20	My teacher wants me to read books that help me learn new ideas in science.	.372	.544
13	My teacher asks me to do science experiments.	.003	.543
18	My teacher asks me to make predictions based on what I read in science.	.088	.518
14	My teacher asks me to draw concept maps about my science reading.	.190	.518
15	My teacher asks me to explain the important ideas in my science reading.	.226	.445
12	My teacher gives me the right amount of help when science is hard.	.335	.363
11	My teacher gives me big projects to do in science.	.232	.336

## APPENDIX D

### Knowledge Rubric

#### ***Level 1: Minimal Factual Information***

Students present two or less simple facts about either domain.

*Example: In the desert many animals survive and some of them die.*

#### ***Level 2: Expanded Factual Information***

Students present three to six simple facts about either domain.

*Example: The animals that live in a pond are tadpole, frog, fish, turtles, beetles, crawfish, eels, swans. The animals that live in a desert are kitfox, rattlesnake. I think summer is not as hot as the desert. In fact the desert can get up to 105 degrees. In the pond there are coral reef. In the desert the spikiest plant is a cactus. It can have up to 500 spikes on it.*

#### ***Level 3: Factual Information and Simple Descriptions***

Students present multiple facts about either domain and present one within system relationship.

*Example: Ponds and deserts are very different. Ponds have water, bugs, frogs, lots of life in them. Deserts are dried out and lizards and snakes, rats, camels even. But, there the same cause they both have animals and they both have habitats. There are so many things different from deserts and ponds. There are also things the same about deserts and ponds.*

#### ***Level 4: Factual Information and Within System Relationships***

Students present seven-plus facts about either domain along with more than one within system relationship.

*Example: I learned that deserts are the most inhostible regions in the world. Most insects, amphibians, and reptiles were born at a pond. Most ponds are different from each pond. Most ponds also have different animals. Deserts can be cold deserts, too. Few trees live by making their roots go under ground and find the underground water. Most ponds have frogs, lily pads, reptiles, and etc. deserts have reptiles, cactuses, snakes, and etc. reptiles can survive in both ponds and deserts. Foxes can survive in both ponds and deserts, insects can survive in both ponds and deserts. Many other animals can survive in both ponds and deserts. So many animals have two or more habitats sometimes.*

**Level 5: Factual Information, Within System Relationships, and Between System Relationships**

Students present seven plus facts about either domain with multiple within-system relationships and one between system relation.

*Example: Pond plants such as water lilies provide shelter for animals like spiders, frogs, and other amphibians. Fish survive by breathing in the oxygen. Deserts on the other hand are hot. For example, the Sahar highest temperature was 139 degrees. Snakes, lizards survive by storing water with their waterproof skin. Mammals store precious water in their bodies. So, as you can see the major difference is that ponds are cool and warm and deserts are hot.*

**Level 6: Factual Information, Within System Relationships, Between System Relationships, and At Least One Explanatory Concept**

Students present seven-plus facts about either domain are presented along with multiple within and between system relationships and one explanatory concept.

*Example: Well first the biggest desert in the world is the Sahara. The Sahara is in Africa. Little tiny insects live in ponds and they are food for amphibians, toads, frogs, and salamanders. Camels survive by storing fat in there humps. Ponds are polluted by people. It sometimes gets warm by ponds. Snakes, lizards like the heat although they still make shelters underground during the hottest points of the day. Even when it gets cold too. Insect adults go up for air and then they come back to the pond and so they can breed. Lizards only come out at rainfall because since it so hot at the desert that there so small they will turn to crisp.*

**Level 7: Explanatory Concepts in One System Only**

Multiple facts about either domain are presented along with multiple within and between system relationships and at least two explanatory concepts in one biome only.

*Example: One of the difficulties in the desert is trying to find water. The cactus stores water in it's leaves and others store water in bulbs underground. A camel can drink up to 20 gallons of water at once. That is why it does not need a lot of water. A camel can also go a week without being fed. It gets its energy from the fat in its humps. The camel has feet that are soft so it can withstand the intense heat of the desert surface. It has hair in its ears and eyes to keep sand out. Some animals use a hunting grounds others use it to have a drink once in awhile. Some pond animals sometimes may eat other small pond animals. Like when a frog eats a fly. As young frogs grow they take air and come back later to breed. Some animals are adapted to this type of land.*

**Level 8: Explanatory Concepts in Both Systems**

Multiple facts about either domain are presented along with multiple within and between system relationships and explanatory concepts in both biomes are presented.

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