

EFFECTS OF VIDEO-BASED PEER MODELING ON THE QUESTION ASKING, READING
MOTIVATION AND TEXT COMPREHENSION
OF STRUGGLING ADOLESCENT READERS

By

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ABSTRACTEFFECTS OF VIDEO-BASED PEER MODELING ON THE QUESTION ASKING, READING MOTIVATION
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KALLEN E. TSIKALAS

Advisor: Professor Barry J. Zimmerman

Struggling adolescent readers are distinct from others in two important ways: (1) They are *adolescents*; and (2) they have a *history* of struggle with reading.

Good pedagogy prescribes that effective programs “meet students where they are.” For middle-school students, this means meeting them in adolescence. Adolescents are more concerned with social norms and more susceptible to peer influence than younger children. Additionally, the fact that these youth are still struggling after years of reading instruction suggests that their motivation to persist at reading is likely to have suffered. To fully support and engage such adolescents, reading programs must leverage social processes and include explicit support for motivation and strategy use.

This dissertation investigated the effects of a peer modeling instructional intervention on early adolescents’ question asking, reading motivation and comprehension. Videotaped peer models demonstrated the use of question asking for comprehension and motivated participants to use the strategy.

Participants were 48 sixth graders who attended public schools in New York City. Eighty-five percent were classified as reading below grade level. After completing an interactive

tutorial on question asking, all students read a moderately challenging, computer-based science text. While doing so, participants in the Peer Modeling condition observed same-age, similar-ability peer models asking authentic questions about the text. After reading, all participants generated their own questions, completed a short survey, and were assessed for reading comprehension.

The research found that peer modeling had a positive effect on the quality of questions that students asked and their text comprehension. Participants exposed to peer modeling asked more questions that were *not* answered in the text and more deep-level “I’m Confused” questions. They better understood the solution component of the text and recalled more critical idea units. Peer modeling did not affect participants’ motivation or accuracy of comprehension judgments.

In contrast to previous research, the study also found that students asked numerous deep-level questions, but that these questions were not necessarily linked to greater understanding. Additionally, higher motivation was *not* associated with greater comprehension. These findings have implications for the design of systems to support struggling readers and for theory-building about reading comprehension.

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TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION	1
Current Instructional Solutions	3
Strategy Instruction	3
Motivational Support	5
My Intervention	6
Research Goals and Questions	8
Educational Significance of this Study	9
Instructional Implications	9
Theoretical Implications	10
 CHAPTER 2: REVIEW OF LITERATURE	 12
Purpose	12
Overview	12
Addressing Social Aspects of Learning: Leveraging the “Adolescent” in Adolescent Literacy	15
Social Modeling	16
Peer Influence	24
Locating My Research on the Road Map of Reading Comprehension	30
Theories of Reading Comprehension	30
Dimensions of Reading Comprehension	32
Addressing Cognitive Aspects of Reading Comprehension: Strategy Instruction and Question-Generation	35
Strategy Instruction	35

	ix
Question Generation	37
Question Content	39
Amount of Structure Provided in Question-Generation Strategy Instruction.....	45
Peer-Assisted Strategy Instruction.....	48
Review of Selected Peer-Assisted Strategy Instruction Programs	52
Computer-Supported Strategy Instruction	61
Addressing Motivational Aspects of Reading Comprehension	73
Motivation in Reading	73
Effects of Motivation on Reading Comprehension	75
Interventions to Boost Both Motivation and Reading Comprehension	84
Concept-Oriented Reading Instruction	84
Integrating Strategy Instruction with Coping/Attribution Retraining.....	89
CHAPTER 3: METHODS.....	93
Experimental Design.....	93
Participants.....	95
Participant Recruitment	96
Inclusion in the Sample.....	96
Materials	97
Interactive Tutorial on Question Generation as a Comprehension Strategy.....	97
Expository Texts	99
Computer-Based Reading Environment	100
Measures	107
Screening and Baseline Measures.....	107

Outcome Measures.....	111
Procedures.....	118
Participant Selection and Assignment	118
Reading Sessions	120
Assessments	122
Data Analysis.....	123
Data.....	123
Analytic Model	124
Data Scoring Procedures.....	126
Statistical Analyses	130
CHAPTER 4: RESULTS.....	131
Inter-Rater Reliability	131
Inter-Rater Reliability for Question Quality Measures.....	132
Inter-Rater Reliability for Oral Comprehension Measures.....	132
Participants.....	134
Baseline Reading Comprehension	135
Self-Efficacy for Reading	135
Intrinsic Motivation for Reading	136
Use of Reading Strategies.....	136
Fluency.....	137
Participants' Experience of the Task	137
Perceived Text Difficulty.....	137
Text Interest	138

Judgment of Learning	138
Accuracy of Comprehension Judgments	139
Preference for Challenge in Future Texts	140
Question Asking.....	141
Incidence of Question Asking.....	141
Participants' Reasons for Question Asking	142
Depth and Types of Questions Asked.....	142
Question-Text Relationship	143
Comprehension	145
Recall of Idea Units	145
Completeness and Accuracy of Text Understanding.....	146
Application of Prior Knowledge and Misunderstandings.....	147
Relation of Question Asking to Comprehension	148
Effects of Peer Modeling	150
Hypothesis 1: Effects of Peer Modeling on Reading Motivation	151
Hypothesis 2: Effects of Peer Modeling on Comprehension Judgments.....	151
Hypothesis 3: Effects of Peer Modeling on Quality of Question Asking.....	151
Hypothesis 4: Effects of Peer Modeling on Text Comprehension	153
Possible Mechanisms of the Impact.....	155
Effect Size Comparison	157
Contrasting Cases.....	161
Case 1: Brianna and Kayesha - Vampire Bats Text.....	161
Case 2: Jonathan and Isidro –Vampire Bats Text.....	163

Case 3: Desiree and Jacklyn – John Hancock Tower Text.....	165
Case 4: Andre and Sherwin – John Hancock Tower Text.....	167
CHAPTER 5: DISCUSSION.....	169
Overview of Major Findings about Effects of Peer Modeling	169
Lack of Effect of Peer Modeling on Motivation and Comprehension Calibration.....	169
Effects of Peer Modeling on Question Asking	171
Effects of Peer Modeling on Text Comprehension.....	174
Surprises in the Data	176
Incidence of Deep-Level Question Asking.....	176
Perceptions of Text Difficulty	178
Role of Motivation in Text Comprehension	179
Role of Question Asking in Text Comprehension.....	181
Strengths and Limitations	182
Implications and Directions for Future Research	184
Understanding Struggling Adolescent Readers	184
Theory-building about Reading Comprehension and Reasoning	185
Design of Computer-Based Learning Environments.....	187
Directions for Future Research	187
APPENDIX A: RESEARCH INSTRUMENTS	189
Reading Pre-Survey	189
Reading Post-Survey.....	191
Question-Asking Worksheet.....	193
Sample of Structured Oral Interview	194

Sample SVT Assessment	196
APPENDIX B: MATERIALS	197
Sample Note to Parents Introducing the Study	197
Sample Recruitment Message for Automated Telephone Calls Made by Schools	198
Experimental Texts	199
Screen Shots of Interactive Strategy Instruction Tutorial	202
APPENDIX C: CONSENT FORMS	203
Parental Permission Form	203
Student Assent Form	205
BIBLIOGRAPHY	206

LIST OF TABLES

Table 1: Research Design	94
Table 2: Specifications of Experimental Conditions	95
Table 3: Characteristics of Experimental Texts.....	100
Table 4: Characteristics of Peer Modeling Videos	103
Table 5: Summary of Procedures for Research Sessions with Students.....	123
Table 6: Summary of Data Collected.....	124
Table 7: Scoring of Problem and Solution Understanding	129
Table 8: Relation of Accuracy of Comprehension Judgments to Text Interest	140
Table 9: Summary of the Incidence and Types of Questions Participants Asked	144
Table 10: Correlations between Question Asking and Text Comprehension.....	149
Table 11: Group Means and Standard Deviations for Question Asking	153
Table 12: Group Means and Standard Deviations for Text Comprehension.....	155

LIST OF FIGURES

Figure 1: Current Study as related to RRSg Reading Comprehension Framework.....	35
Figure 2: Visual Mnemonics for the Question-Types.....	99
Figure 3: Screen Shot of Computer-Based Reading Environment	102
Figure 4: Question Prompt for Control Condition.....	105
Figure 5: Question Prompt for Peer Modeling Condition	106
Figure 6: Goals for Reading Activity.....	121
Figure 7: Analytic Model.....	125
Figure 8: Effect Size Comparison.....	160

CHAPTER 1: INTRODUCTION

The National Center for Education Statistics (NCES) (2003) estimates that nearly ten percent of students in grades 4-12 (over 8 million children) are struggling readers who cannot navigate and master middle- and high-school content. Furthermore, more than 3,000 students drop out of high school each day, in large part because they lack the literacy skills to be able to keep up with increasingly complex secondary school curricula (Kamil, 2003). Despite recent gains, children in New York are no different from national averages. For example, according to *The Nation's Report Card: Reading 2007* (Lee, Grigg, and Donahue, 2007), nearly one-third of 8th grade boys in New York and 38% of NY 8th graders who were eligible for free or reduced lunches read at a level that is considered *below basic*.

By the time they reach adolescence, young people are reading to learn rather than learning to read (Chall, 1983), and the expository texts they encounter are more abstract and require greater inference-generation (Stein & Trabasso, 1981). As reading becomes the primary method for adolescents to acquire background knowledge in a variety of subjects, their academic success becomes more and more dependent upon good reading comprehension. Poor literacy skills limit their opportunities for learning, academic attainment and success in the workplace.

Poor literacy skills also have negative social and motivational consequences for young people. Compared with younger children, adolescents increasingly engage in social comparison processes (Wigfield, Eccles, & Pintrich, 1996; Wigfield, Byrnes, & Eccles, 2006), measuring themselves against their peers in nuanced landscapes of popularity and ability. Struggling adolescent readers quickly become aware of the social consequences (largely negative) of their academic performance. Consequently, they suffer both socially and motivationally (Harmon, Keehn, & Kenney, 2004; Vaurus, Lehtinen, Kinnunen & Salonen, 1991).

As they fall further and further behind their peers, low-achieving students show declines in self-concept, sense of control, self-efficacy, and expectations for success (Olkinuora & Salonen, 1991). Such motivational vulnerability leads children to a variety of avoidance behaviors that only further depresses their reading achievement (Gersten et al., 2000; Morgan & Fuchs, 2007).

What can we, as educators, do to stop this spiral of decline for struggling adolescent readers? How can these students be helped to become better readers and literate members of society?

My dissertation research examines the effectiveness of an *assets approach* to improving adolescents' reading comprehension and supporting their continued literacy development. This approach leverages one of the most important and persistent sources of motivation for early adolescents—peer influence! It also builds upon young people's enthusiasm for using computers and their facility with technology.

The approach is designed to simultaneously address cognitive and motivational challenges faced by struggling adolescent readers. It provides students with interactive strategy training on question generation and then with opportunities to practice and use this strategy when reading. It employs an engaging, computer-based reading environment that allows students to view—*while* they are reading—short, well-timed video-clips of peer models (other kids) who demonstrate how to ask authentic “thinking” questions and offer social support.

Three definitions are in order prior to continuing the rationale for my research and approach. First, “adolescence” generally refers to the second decade of the lifespan. Social scientists often make the distinction between three phases of this period: Early (10-13 years),

middle (14-17 years) and late (18-21 years) adolescence (Steinberg, 2008, pp.6-7). My research involves early adolescents.

Secondly, “assets-based” or strength-based approaches are those that attempt to build upon the capacities, propensities, skills, knowledge, connections and potential in a community to help that community thrive (Kretzmann & McKnight, 1993; Scales & Leffert, 2004). In the case of my research and approach, the community is the adolescents themselves.

Finally, in this dissertation, the term “authentic questions” refers to questions students ask that are *unscripted* by teachers or adults. These questions originate completely from the young people themselves.

Current Instructional Solutions

Research suggests that to best help older students become better readers, instruction must address both cognitive and motivational aspects of their comprehension deficits (Guthrie & Wigfield, 1999; Guthrie, McRae & Klauda, 2007; Vaurus et al, 1991).

Strategy Instruction

Cognitive support for reading has generally been provided in the form of comprehension strategy instruction. There is ample evidence of the effectiveness of explicit strategy instruction on children’s reading performance (Block, Gambrell & Pressley, 2002; Duke & Pearson, 2008-09; Gersten, Fuchs, Williams & Baker, 2001; McKeown, Beck, & Blake, 2009; NICHD, 2000; Rosenshine, Meister, & Chapman, 1996). Furthermore, children with reading-skill deficiencies (lower-achievers) may especially benefit from strategy instruction (Dole, Brown, & Trathen, 1996; Duffy et al., 1987; Johnson-Glenberg, 2000; Palincsar & Brown, 1984). Seven strategies,

in particular, have been shown to have strong track records at improving reading comprehension (NICHD, 2000). These are comprehension monitoring, cooperative learning, question generation, question answering, summarization, story structure, and graphic and semantic organizers.

My study involves training adolescents to use a particular question generation comprehension strategy. Question generation is the act of composing questions about a text during or after reading. It is thought to improve comprehension in several ways—by focusing the reader’s attention on the content of the text, supporting the reader in maintaining an active stance during reading (Sinatra, Brown, & Reynolds, 2002), stimulating inferencing and explanation (King & Rosenshine, 1993), sensitizing the reader to what she does not understand in the text (Palincsar & Brown, 1984; Rosenshine et al., 1996), and helping the reader to create more situated representations of new content (King, Staffieri, Adalgais, 1998).

Questioning strategies differ in terms of their question content, the amount of structure or guidance that is provided to learners in the form of “procedural prompts,” and the method by which students learn to ask themselves questions. My approach involves a moderate amount of structure provided in the form of three question categories—Think & Search, I Wonder, and I’m Confused questions. Within each of these types, peer models ask various kinds of authentic, unscripted, and “situated” questions. This approach borrows most heavily from the ASK to THINK, TEL-WHY method of King and colleagues (King, 1994, 1998, 2002; King & Rosenshine, 1993).

Strategy instruction, such as that on question asking, may be implemented through a variety of modes. Most common are direct instruction, *peer-assisted* methods (Fuchs, Fuchs, & Burish, 2000; Ginsburg-Block, Rohrbeck & Fantuzzo, 2006; Rohrbeck, Ginsburg-Block,

Fantuzzo & Miller, 2003; McMaster, Fuchs, & Fuchs, 2006; Topping, 2005) and *computer-supported* approaches (Dalton & Proctor, 2007; Proctor & Dalton, 2007; Graesser, McNamara, & VanLehn, 2005; McNamara, O'Reilly, Rowe, Boonthum, & Levinstein, 2007). These latter two approaches offer expanded potential for reaching struggling readers both cognitively and motivationally.

Despite the plethora of effective strategy training programs, though, many teachers continue to feel unequipped to accommodate the diverse instructional needs of their lower-achieving students (McMaster et al., 2006). For example, even though peer assisted learning (PAL) interventions have strong appeal, fewer than 20% of teachers choose to implement such programs (Rohrbeck et al., 2003). A possible explanation for this “low uptake” is the teachers do not feel well enough prepared or supported to implement such strategy training interventions with the wide variety of students in their classes (McMaster et al., 2006).

There may also be barriers associated with use of the particular strategy that has been targeted for instruction. For example, regarding question generation, Graesser & Person (1994) identified several barriers that students face in asking questions in classrooms. Metacognitively, they often have trouble identifying their own knowledge deficits. Socially, they may risk a loss of status when they “reveal ignorance” or ask a “bad” question. Finally, lower-achieving students may actually be *socialized not to ask questions* in typical classrooms (Good, Slavings, Harel, & Emerson, H.1987). Therefore, even when sound instruction is provided, students may be disinclined to use the strategy.

Motivational Support

Motivational support for reading has generally been provided by adapting reading contexts, activities, and texts so that they provide higher-interest content and greater

opportunities for young people to exercise choice and autonomy and to collaborate or learn from peers (Ginsburg-Block et al., 2006; Guthrie et al., 2007; Guthrie, Wigfield, Barbosa, Perencevich, Taboada, Davis, et al., 2004; RRSF, 2002). Additionally, some literacy interventions have been explicitly designed to boost self-efficacy (Schunk & Zimmerman, 2007) and address maladaptive attributions (Vaurus et al., 1991).

Again, however, these types of interventions often involve significant investments on the part of teachers and schools or districts. As such, their implementation may be limited. Additionally, social compatibility issues in the classroom are generally more pronounced for socially-sensitive adolescents than for elementary students (Steinberg, 2008). These can interfere with the effectiveness of typical peer-assisted learning interventions (Klinger, Vaughn, Arguelles, Hughes, & Leftwich, 2004).

My Intervention

The approach employed in this study leverages the power of positive peer influence to improve early adolescents' reading engagement and comprehension. This computer-based, peer modeling intervention simultaneously instructs the students about the use of a question-generation comprehension strategy and provides support for motivation.

My approach expands existing instructional frameworks by adding a dimension of social learning—rooted in constructs of social modeling (observational learning) and peer influence (social norms correction)—that is particularly salient for adolescent learners.

In contrast to traditional PAL programs or peer modeling interventions, the peer video-taped models in my intervention ask *authentic, unscripted* questions. Their questions are *decidedly non-expert* in structure, form and content. Consequently, they may be better able to reach struggling readers in their respective Zones of Proximal Development (Vygotsky, 1978).

Furthermore, these models appear more as supportive friends than as tutors and, as such, may trigger ambient peer learning processes (Parr & Townsend, 2003) that are more palatable to lower-achieving adolescent learners.

Finally, because of the types of questions they ask, these peer models do not appear as mere extensions of the teacher. In my pilot research, more than half of participants commented that they wanted to help the peer models find the answers to their questions. They contrasted the models' "real questions" with the kinds of questions that teachers ask, saying that they knew that teachers' questions weren't real because the teachers already knew their answers. Additionally, one student (who had already failed 6th grade once) remarked:

Usually when people try to persuade me to do something [like read things that he finds boring], I do the opposite. But this was different. These kids' questions grabbed me and they made me want to think.

My intervention also addresses teachers' barriers to implementing strategy training programs by requiring less of an initial investment. It is offered as supplement, rather than a replacement, to current classroom practices. Educators who participated in the study, for example, expressed interest in using this approach in pull-out and after-school programs that often lack structure. Because it is computer-based and largely self-contained, it requires little strategy expertise on the part of the teacher and may be adopted without delay. However, also because it is computer-based and designed as a customizable tool, interested teachers may add their own content and build upon the approach in ways they feel most appropriate and effective for their students.

Finally, my intervention addresses barriers to students' question asking through the use of video-taped peer modeling. Models are same-age children who are average readers. Through

video- and/or text-representations, they demonstrate how to use a question generation strategy. Additionally, they communicate information about performance standards, self-efficacy, and social norms. Since they are not physically present and known to the students, social incompatibility issues are avoided.

Research Goals and Questions

With this intervention as its basis, my dissertation investigates the *extent to which* and the *mechanisms by which* positive peer influence/modeling induces or improves adolescents' behaviors and motivations around reading comprehension. Five research questions are investigated in the study:

1. What are the effects of peer modeling/influence on the reading motivation of struggling adolescent readers?
2. What is the effect of peer modeling/influence on these students' self-monitoring as indicated by the accuracy of their comprehension judgments?
3. What are the effects of peer modeling/influence on the quality of questions that such students ask about expository texts?
4. What are the effects of peer modeling/influence on these students' comprehension of expository texts?
5. If effects are present, what processes (motivational, self-regulatory, strategic or other) best explain them?

Educational Significance of this Study

This research may have important consequences for teaching struggling adolescent readers and as well as for developing more accurate and comprehensive theories about the relation between motivation and reading comprehension for a variety of learners.

Instructional Implications

Video-based peer modeling of comprehension strategies may provide teachers and literacy coaches with a low-cost, scalable, highly participatory and distinctly appealing instructional intervention for diverse adolescents. The intervention could be used in extended day or pull-out instruction as well as in out-of-school contexts, such as after-school programming and home learning situations.

Teachers could recruit their own students to serve as question-generation models for the next year's students. They could video-tape these students reading and posing questions, and then provide struggling readers with access to these short video-clips while they read the texts. Already, both students and teachers who participated in my pilot research have expressed interest in this possibility.

Furthermore, after students have brainstormed their "Think & Search, I Wonder, and I'm Confused" questions for the video compositions, teachers and literacy coaches might engage them in a high-level discussion about how to find answers to their questions and how to determine which inquiries might pull them further afield—reducing rather than enhancing their comprehension. This latter point is especially important because research has shown that weaker readers, more than others, may undermine their comprehension by relating prior knowledge that is not directly relevant and by making unwarranted inferences as they do so (Trabasso & Suh, 1993; Williams, 1993).

This approach may also help students relearn the purpose of asking questions in school, and reengage them in reading. My pilot research with 25 middle-school students was quite eye-opening in this regard. Many of the young people I worked with (average readers) held the belief that “you ask the question when you’re sure you know the answer.” Once instructed on productive question-generation and encouraged to ask the questions they really had, the students came forth with wonderful and perplexing questions about the text passages they had read. The questions they asked were not easily answered, and most were not of the sort one would find in a text book. They were much more interesting.

Finally, certain patterns of question asking by students may be explicit markers of certain types of misunderstanding. Teachers could plan to explicitly address these question types to promote comprehension among lower-performing readers. Alternately, teachers might use student-generated questions as diagnostic tools to decide on appropriate intervention strategies.

Theoretical Implications

This research extends current theory by examining the effects of peer modeling on specific reading comprehension behaviors at a fine-grained level. In addition to exploring students’ depth of question asking, it investigates how their motivation for question asking and the degree to which their questions are answered in the text are associated with comprehension and influenced by peer modeling.

Additionally, the study provides greater clarity on the *relation between motivation, strategy use and comprehension for low-achieving, ethnically diverse adolescents*. There are discrepancies in the literature about both subgroups, and more experimental studies are needed to clarify the opportunities and obstacles for such students (Guthrie & Wigfield, 2004; Unrau & Schlackman, 2006).

Finally, my study differentiates the effects of modeling on strategy use, multiple motivational factors (e.g., text interest and preference for challenge), self-monitoring in the form of accurate comprehension judgments, and multiple dimensions of reading comprehension. This level of precision is required to more accurately understand the phenomenon.

CHAPTER 2: REVIEW OF LITERATURE

Purpose

The purpose of this literature review is to answer two sets of questions: (1) *How* my study relates to existing research on adolescent literacy acquisition and how it extends current theories and practices; and (2) *why* I selected this particular intervention – why question-generation, why peer modeling, and why computer-based strategy instruction. The chapter is structured around five broad topics:

1. Addressing Social Aspects of Learning: Leveraging the “Adolescent” in Adolescent Literacy
2. Locating my Research on the Roadmap of Reading Comprehension
3. Addressing Cognitive Aspects of Reading Comprehension: Strategy Instruction and Question Generation
4. Addressing Motivational Aspects of Reading Comprehension: General Relations, Specific Constructs, and Extenuating Circumstances
5. Interventions that Support both Cognitive and Motivational Aspects of Reading Comprehension

Overview

Historically, literacy interventions have focused on early childhood, with the understanding that the earlier a child’s literacy problems are identified and addressed, the better his chances of success. As children progress through school, the effects of their reading problems multiply. Not only do children with poor reading skills suffer academically (because

they lose access to knowledge and information that is generally acquired through reading), but they suffer socially and emotionally, as they fall further and further behind their peers (Chall, 1983; Harmon, Keehn, & Kenney, 2004; Vaurus, Lehtinen, Kinnunen & Salonen, 1991).

Struggling adolescent readers are distinct from others in two important ways: (1) They are *adolescents*; and (2) they have a *history* of struggle with reading.

Good pedagogy prescribes that effective programs “meet students where they are.” For middle- and high-school students, this means meeting them in adolescence. More than a just developmental context, adolescence is a state of mind in which social interactions and individual autonomy are paramount. During this period, which extends from age 10 to 21, young people experience pivotal changes in physiology, brain development and social environments. Partially as a result of these shifts, adolescents engage in much greater social comparison than younger children, and they tend to define themselves primarily in relation to their *peers* (fitting in and standing out). They are more concerned with social norms, more susceptible to peer influence, and more likely to seek autonomy from parents (Brewer, 1991; Steinberg, 2008; Wigfield et al.1996; Wigfield et al., 2006). To fully support and engage them in reading, *instructional programs must include social processes*.

Additionally, the fact that these young people are still struggling after six or seven years of reading instruction suggests that traditional instructional approaches have not worked for them. Therefore, it is paramount that they learn *effective strategies* to lift their reading comprehension and compensate for skills they have lacked over the years.

More importantly, the fact that they are still struggling to read by age 11 or 12 suggests they have experienced repeated failures that may challenge their motivation to pursue and persist at reading. Indeed, they are likely to have developed sets of behaviors and beliefs that protect or

buffer them from negative feelings associated with poor reading performance. Avoidant behaviors, passive behaviors, negative beliefs about the value of reading in their lives, and negative beliefs about their own capacity to succeed can hinder their learning and progress (Harmon et al, 2004; Vaurus et al, 1991, Morgan & Fuchs, 2007).

Maladaptive motivational patterns, then, are both a consequence of reading difficulties and a cause of later reading failure—creating a situation of “negative Mathew Effects,” a situation where the poor just keep getting poorer (Guthrie & Wigfield, 1999; Morgan & Fuchs, 2007; Stanovich, 1986). Because of this particular history, it is likely that any reading comprehension program that is to succeed with struggling adolescent readers must include *explicit support for motivation*.

My study investigates the effects of positive peer influence on early adolescents’ reading engagement and comprehension. The computer-based, peer modeling intervention that I employ in this study simultaneously instructs the students about the use of a question-generation comprehension strategy and provides support for motivation. The videotaped peer models in the Peer Modeling/Influence condition not only demonstrate how to implement the question-generation strategy (providing situated information and instruction), but they also model positive self-beliefs, higher standards of performance, and acceptable norms of behavior (asking questions and indicating that one does not completely understand a text).

To begin this literature review, I describe characteristics of an intervention that is likely to reach adolescents where they are – in a fluid, if not turbulent, state of transition in which social factors and social influences dominate. Citing *research about adolescence*, I examine how social modeling (observational learning) and peer influence may explain the promise of interventions like the one I have employed.

I then locate my research assumptions and questions within a *broad framework of reading comprehension*. Next, I address *cognitive aspects of reading comprehension*, building upon an extensive literature in strategy instruction for reading comprehension. This includes studies of questioning, peer-assisted strategy instruction, and computer-supported strategy instruction. I also describe how my work addresses the limitations of these approaches, particularly with regard to implementation issues, motivation issues and support for struggling readers.

Finally, I address *motivational aspects of reading comprehension*. I first summarize research on the relation between motivational constructs and reading comprehension. I discuss how factors such as achievement level and ethnicity may moderate these relationships, and I describe two very different instructional approaches to boosting both motivation and reading comprehension.

Addressing Social Aspects of Learning:

Leveraging the “Adolescent” in Adolescent Literacy

Adolescence is a time of transitions—the period in the lifespan when one experiences great changes in a relatively short period of time. Physiologically, adolescence corresponds with the onset of puberty and subsequent changes in interest from same-sex to mixed-sex or opposite-sex activities. Cognitively, adolescence is associated with the shift from concrete operational to abstract thinking. Correspondent with this ability to think more abstractedly, adolescents are better to identify similarities and difference in individuals and groups. During this period, they begin to categorize themselves and others and engage in much more pronounced social comparison—judging their academic performance, social status, and appearance in reference to

that of others (Steinberg, 2008; Wigfield, Byrnes & Eccles, 2006; Wigfield, Eccles & Pintrich, 1996).

Finally, due to changes in the contexts of schooling (the structure of middle schools in comparison to elementary schools), changes in family structures and employment patterns, and adolescents' own desire for greater autonomy, young people spend relatively more time with peers and less time with adults (Eccles, Midgley, Wigfield, Buchanan, Revman, Flanagan & MacIver, 1993; Steinberg, 2008). Indeed, by the time children turn 18, they have spent only 13% of their waking hours in the classroom. In contrast, they spend more and more time with peers (Gibbs, 2005; Larson & Verma, 1999).

These physiological, cognitive and social changes make young people more predisposed to social influences and more concerned about both fitting in (peer acceptance/assimilation) and about standing out (differentiation) (Blanton and Burkley, 2008; Brewer, 1991). Social comparison processes are a hallmark of adolescence and essential element of adolescents' identity formation.

Might there be a way to harness the natural social proclivities of adolescents to help them improve their literacy skills?

Two theoretical constructs guide us in thinking about the possibilities. These constructs are *social modeling* and *peer influence*.

Social Modeling

Social modeling refers to the “process in which observers pattern their thoughts, beliefs and behaviors after those displayed by one or more models” (Schunk & Zimmerman, p. 11). It

functions through three primary pathways—inhibition/ disinhibition, response facilitation, and observational learning.

Of particular importance to this investigation, *observational learning* is a means by which one learns from observing the performance of models, hearing their explanations, and discerning the consequences of these actions and verbalizations (Bandura, 1986; Zimmerman & Kitsantas, 2002). More than simple response mimicry or identification, observational learning involves a psychological abstraction process: After watching others, the learner forms an internal, cognitive model of the behavior as well as standards for response. This internal model guides the learner in initiating, monitoring and correcting her performance (Bandura, 1986). After forming this internal representation of performance, learners may emulate the model's performance by trying to “do it themselves.” Later, they may attain self-regulated levels of performance.

Models can both inform and motivate learners (Schunk & Zimmerman, 2007). Through modeling, new behaviors, beliefs and self-evaluative standards may be developed. Additionally, existing behaviors, beliefs, and self-evaluative standards may be reinforced (Bandura, 1986; Zimmerman, 2000). This study seeks to discern to what extent social modeling can induce or improve adolescents' behaviors and motivations around reading comprehension. Targeted behaviors include use of comprehension strategies, namely question asking and self-monitoring of comprehension. Targeted motivations include text interest (including enjoyment and curiosity) and preference for challenge.

Outcomes. Empirical evidence provides reasons for optimism about the possible effects of social modeling on outcomes targeted in this study. Rosenthal, Zimmerman, and Durning (1970) demonstrated that underperforming, Latino sixth graders (primarily Mexican-American

students) could learn to formulate specific types of questions about pictures of objects. In particular, the children learned to ask deeper-level questions, such as those involving causal relations (“When does the bell on the typewriter ring?”) and functional uses (“Could you put water in this?”) of objects after observing an adult model ask these same sorts of questions.

Participants in the experimental conditions were exposed to an adult model who asked one class of question, out of four possible types, about pictures of objects. The four classes consisted of questions about physical attributes, pragmatic functions, causal relationships, and value judgments. Notably, the adult model presented multiple and diverse examples of each question type.

At three phases (baseline, emulation-just after modeling, and generalization-following the presentation of a new set of object pictures), children were instructed to formulate their own questions. In comparison to no-model control groups, students who observed the model learned to ask more questions of the response class they saw modeled. Indeed for all categories of questions, observing a model greatly increased the children's production of that type of question. Furthermore, exact mimicry of model's questions was uncommon, occurring in only about 12% of the generated questions. Participants who were explicitly instructed to “Try as hard as you can to make your questions like the lady's questions” were more likely to produce exact copies of the model's questions. These results suggest that children were able to abstract the interrogative classes implied by the type of question they saw modeled.

More recently, emerging research by Lopez, Roberts, Monden, Rasmussen, Rettew, Ackerman, & Cole (2008) found that academically-challenged college students gained study skills and improved performance by observing peer models. In their investigation, undergraduates who were on academic probation watched selected *You Tube* videos posted by

other students who had successfully overcome the same situation. They viewed approximately one video per month over one semester and wrote a reflection piece on each one. Compared to students in a no-model control, these students improved in study skills and grades over the term.

Especially important to note about this study is that the modeling episodes (*You Tube* videos) were not produced for this project per se. They were simply located from among the millions of videos posted by individuals on the social media site. As such, there was no consistent message or strategy advocated by the models. Instead, there many authentic and diverse examples of how young people overcame a substantial academic and motivational challenge.

A number of studies have also demonstrated the positive effects of modeling on *writing* performance and revision (Graham & Harris, 1989; Graham & Perrin, 2007; Zimmerman & Kitsantas, 2002). Using a multiple-baseline across-subjects design, Graham & Harris (1989) examined the effects of strategic modeling on composition writing. Participants were three, learning disabled sixth graders who learned three-step strategy, which involved the TREE strategy (note *Topic* sentence, note *Reasons*, *Examine* reasons, note *Ending*) for writing essays. This strategy was modeled by an adult instructor who “thought aloud” while writing an essay. The instructor also modeled four types of self-instruction (problem definition, planning, self-evaluation, and self-reinforcement) and later discussed with the students the importance of what we say to ourselves while we are working on a problem.

Two weeks following the training, participants responded to probes by writing essays. All three students experienced substantial gains over baseline in the number of words and functional elements included in their essays (e.g., premise, reason, and conclusion) and the coherence of their essays. Additionally, two of the students demonstrated an increase in self-

efficacy following instruction. These effects were maintained over time and transferred to a new context.

Finally, research has shown positive effects for modeling on motivation. For example, using a puzzle task, Zimmerman & Ringle (1981) examined the effects of two levels of model persistence (high or low) crossed with two levels of model statements about confidence of reaching a solution (confident or pessimistic) on young children's persistence and self-efficacy. Participants in the study were low-income, minority students in first and second grade.

Compared to a no-model control group, participants who observed the high persistence, confident model persisted significantly longer at the task, $F(1, 80) = 6.60, p < .05$. Students who watched the low persistence, pessimistic model also persisted longer than those in the control group, but these differences only approached significance, $F(1, 80) = 2.41, p < .07$, one-tailed. These effects on persistence generalized from an object puzzle to a word puzzle.

The effects on participants' self-efficacy judgments were less clear. Significant changes in self-efficacy were observed only for the low persistence, pessimistic group: These children experienced a significant *decline* in self-efficacy. The authors noted that the children's initial level of self-efficacy was very high, and that the efficacy ratings of young children might be less reliable indicators of performance. However, they also offered several hypotheses related to social costs and pressures about behaving as the model did but not necessarily sharing his efficacy beliefs.

Following a similar line of inquiry, Schunk & Hanson (1985) conducted research around children's ability to apply a subtraction strategy. Participants in the study were 8-11 year old children whose teachers assessed them as likely to have difficulty with the mathematical procedure. In the study, they received two 45- minute instructional sessions on consecutive

school days. In each of these sessions, children watched a 15 minute video that demonstrated the mathematical operations involved in the subtraction procedure. In these videos, a teacher first offered instruction on the procedure. Then, a same-sex model demonstrated the procedure by solving (or attempting to solve) multiple problems.

Peer mastery and coping models, and adult mastery models were included in the study. Mastery models performed the operations correctly and worked at an average pace. While problem-solving, these models “thought aloud” about the solution process. They also verbalized statements reflecting high self-efficacy (e.g., "I can do that one"), low task difficulty ("That looks easy"), and positive attitudes ("I like doing these"). After successfully solving problems, they received feedback from the teacher that their answers were correct. In contrast, coping models hesitated, occasionally made mistakes and verbalized less positive self-beliefs (“I’m not sure I can do that one.” and “I’m not very good at this.”) and attitudes towards the task (“That looks tough” and “This isn’t much fun.”). As the coping models persisted in the task, though, their performance and their verbalizations improved. By the second tape, they no longer hesitated or made errors.

The researchers found that children who observed a same-sex peer model (either coping or mastery models) acquired greater self-efficacy for learning than those who observed a same-sex teacher mastery model. Furthermore, students in any of the three modeling conditions achieved higher levels of performance than those in the control condition.

Characteristics of models that influence learning. The previous two studies underscore the fact that characteristics of models do affect the inducement of learning. Moreover, Bandura (1986) reminds us that people are highly selective in the behaviors they adopt from others.

Generally, they select which behaviors to attend to and emulate on the basis of model and response characteristics.

Schunk and his colleagues (Schunk, 1987; Schunk & Hanson, 1985) characterized the attributes of models that are most associated with learning. Reviewing 29 studies on the effects of modeling on children's behaviors in a number of different domains, Schunk (1987) identified several model attributes that related to the success of the instructional interventions:

- ***Perceived Similarity***. Observers are more likely to emulate those who are similar to themselves as they *expect similar outcomes*. Furthermore, the *appropriateness of a behavior* often depends on factors such as age, sex and status. As such, observers are likely pattern their behaviors and beliefs after those who share these characteristics.
 - *Age similarity*. In general, children are as likely to model the behaviors of adults as of other children. However, peer models may be more effective for children who hold self-doubts about their learning or performance difficulties. In these cases, lower-achievers may gain self-efficacy from watching age-mates persevere and succeed at a task.
 - *Gender similarity*. Children can learn from models of either sex. Though the sex of models does seem to affect children's performance, this often depends on the nature of the behavior being modeled and whether it is very gendered.
- ***Competence***. Children are likely to pattern their behaviors after models they perceive to be competent. Competence, in this case, is not an absolute property. Rather, it is determined by the observer's own ability level, such that higher-achieving children may perceive an average-achieving peer model as incompetent, whereas their lower-achieving age-mates may perceive this same model as being competent.

- ***Mastery vs. Coping Models.*** Mastery models demonstrate faultless performance of a behavior, whereas coping models initially display performance deficiencies, fears and negative self-talk that may be more typical of observers. Whether coping models are more effective than mastery models appears to depend on children's prior perceptions of and experiences with a particular task. Coping models may be especially effective in cases where children have had difficulties in the past with the task or perceive themselves more like coping models.
- ***Symbolic vs. Live Models.*** Modeling can occur through live, physical demonstration or through verbal description, pictorial representation, or multi-media representation that combines textual, audio and visual stimuli. The latter types of modeling are referred to as symbolic. Children can learn equally well from live and symbolic models. However, symbolic modeling has the potential to impact far more people and also to change learners' conceptions of social reality (Bandura, 1986, p. 70). This latter point will be discussed in the following section on peer influence and social norms correction.

Structural features of modeling episodes that influence learning. In addition to the attributes of models themselves, structural characteristics of the episodes are important. For example, in the previously described study, Rosenthal et al. (1970) found that to facilitate abstraction, the question-asking models needed to both *explicitly label interrogative classes* and to provide a *variety of examples of each type of question* as applied to specific objects.

Situational cues that influence learning from models. Situational cues, including social inducements and personal significance, can also serve to induce or maintain modeled behavior. Bandura (1986) notes that personal significance may be especially important in

situations where there are no extrinsic incentives. Personal significance may be indicated by *self-evaluative* and *affective reactions* to the task.

My intervention. My intervention employed symbolic (videotaped) peer modeling of both information and motivation to improve reading comprehension. Models were same-age children who are average readers. On video, these models demonstrated how to use a question generation strategy. Additionally, they communicated information about performance standards and self-efficacy.

While the peer models in my study were not coping models per se, that is they did not initially demonstrate deficient behaviors or beliefs and they did not think aloud about their motivational states, these children were similar to coping models. In particular, they demonstrated questions are authentic and unscripted. As such, they communicated a formulation of questions that was *decidedly non-expert* in structure, tone and content. Such questions may be more accessible to and closer to the Zone of Proximal Development (ZPD, Vygotsky, 1978) of the struggling readers in my study.

Models of both genders were included in my intervention, and the modeling episodes featured multiple, diverse examples of each question type. Finally, to facilitate participants' abstraction of these question types, interrogative classes were labeled (e.g., "I'm Confused" or "I Wonder") in videos.

Peer Influence

Peer influence, sometimes labeled "socialization," refers to the processes by which children affect their age-mates (Dishion and Dodge, 2005). It is a knotty phenomenon – having complex effects on short- and long-term individual behavior and being modulated by a multitude of other factors. Among the many moderating and mediating factors of peer influence are:

characteristics of the individual being influenced, including an individual's susceptibility to influence; characteristics and salience of influence source; dynamics of the relationship between the peers; developmental considerations; and abilities and opportunities to perform or exhibit the socialized behavior (Brown, Bakken, Ameringer, Mahon, 2008; Hartup, 2005).

Despite its complexity, evidence abounds about the effects of peer influence on adolescents—particularly *negative* influence. The list of problem behaviors associated with negative peer pressure runs the gamut from aggression and depression to alcohol abuse, smoking, drug abuse, risky sexual behaviors, and risky driving behaviors to gang membership and criminality (Gifford-Smith, Dodge, Dishion & McCord, 2005).

While there is less published about the *positive* effects of peer influence on adolescents, existing research has documented positive peer influences on young people's academic achievement (Berndt, Laychak, Park, 1990; Mounts & Steinberg, 1995), responses to achievement-related failure (Altermatt & Broady, 2009), achievement motivation (Berndt et al., 1990; Wentzel, 1999), study skills (Lopez et al., 2008), and comprehension monitoring (Karabenick, 1996; Hacker & Bol, 2004).

Additionally, in a meta-analysis examining the effectiveness of peer-assisted learning programs that will be reviewed later in this chapter, Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller (2003) note that when “social influences provide students with consistent messages about the importance of academic success, students are more likely to internalize these values and pursue positive academic goals” (p. 242).

Indeed, the premise of peer influence is so compelling that the Fund for Improvement of Post-Secondary Education (FIPSE) has supported the University of Idaho in its development and

investigation of an approach to improve the academic performance and graduation rate of its students through peer influence (NSNI, 2010a).

For this discussion on leveraging positive peer influence to support adolescents' reading comprehension, however, the valence and types of peer influence are less important than the *mechanisms* by which peers affect each other. Within the large body of research on peer influence, one line of inquiry stands out as being of particular value. This work describes the ways adolescents *perceive and misperceive social norms* (Prentice, 2008; Miller and Prentice, 1996; Prentice & Miller, 1993; Nisbett & Kunda, 1985). Findings from such research have led to the design of effective and cost-effective *norm-correction interventions* (Prentice, 2008; Ott & Doyle, 2005; NSNI, 2010b).

Social norms. Social norms characterize where a *group* of individuals stands in relation to a particular attitude or behavior (Miller and Prentice, 1996). Groups may have norms for personal appearance (e.g., hair and dress styles for teen-agers), opinions (e.g., liberal views on college campuses), personal characteristics (e.g., independence or group-centeredness), and behaviors. They may also have norms for acceptable levels and types of academic achievement, including values around reading and striving to comprehend texts. The communication and enforcement of social norms is often inexplicit. In their review of the environments, processes, and mechanisms of peer learning, Parr & Townsend (2003) refer to this as “ambient” learning.

Researchers distinguish between two types of social norms—descriptive and injunctive. As the name implies, *descriptive norms* indicate what group members are like; *injunctive norms* describe what they should or are supposed to be like (Prentice, 2008; Cialdini, Kallgren & Reno, 1991). Two fundamental properties of these norms modulate their influence on group members' behavior:

- The *central tendency* of a norm describes an average level of behavior or a typical attitude for a group, and it determines the direction of influence or the extent to which members enact normed behaviors or endorse normed beliefs. For example, if adolescents perceive that their peers study about an hour a night, they are likely to adopt a similar pattern of studying. On the other hand, if they believe their peer group studies at least four hours a night, they may be more likely to study more themselves. Similarly, if young people believe their peer group invests minimal effort in understanding a text, they are likely to invest little effort themselves.
- The *dispersal* of a social norm indicates the uniformity with which group members follow it or the degree to which a range of different responses is acceptable. This property determines the strength of influence or the amount of pressure that group members may feel to conform to the norm. For example, if every single member of adolescents' peer group wears a particular type of sneaker, the individual may feel greater pressure to himself wear these shoes. If only about half of his group wears this particular shoe style and others wear whatever they want, the individual will likely feel greater freedom to choose a different type of sneaker. Similarly, if young people perceive that peers do not ask questions about a text (presumably because they fully comprehend it), they may feel greater pressure not to ask questions themselves and certainly not to reveal their lack of comprehension. Graesser & Person (1994) further discuss this phenomenon when they review barriers to question asking. Their research will be examined later in this chapter.

The types and properties of social norms are important in that they determine the direction and strength of peer influence. However, they also represent areas in which young

people may *misperceive or inaccurately judge* the norm. Consequently, they may adopt patterns of behavior that are more extreme, often more maladaptive, than required by the group.

Misperceptions of social norms. There is ample evidence that adolescents misperceive social norms related to unhealthy behaviors such as alcohol, drug and tobacco use. Research shows that they over-estimate how often and how much their peers engage in such activities (Page, Hammermeister & Roland, 2002).

Less research has been conducted on adolescents' perceptions of social norms for specific academic behaviors and attitudes, such as reading comprehension and the use and value of reading comprehension strategies. However, it has been established that peers are the greatest influencers of adolescents' day-to-day behaviors in school, e.g., how much time they spend on homework and their classroom behaviors (Steinberg, Dornbusch & Brown, 1992; Steinberg, Brown & Dornbusch, 1996). As such, it is reasonable to infer that peers may also communicate and enforce norms around reading behaviors.

Norm correction interventions. Social Norms Theory predicts that correcting such misperceptions will have a beneficial effect on adolescents' beliefs and behaviors. Norm correction is accomplished by providing young people with credible and accurate information on the actual norm. With repeated exposure to a variety of data-based messages, the misperceptions that serve to sustain a problematic attitude or behavior may wear away.

Norm correction intervention programs have reported success in (a) changing misperceptions and (b) positively adjusting behavior for junior high age- to college-age adolescents (Ott & Doyle, 2005; Prentice, 2008; NSNI, 2010). In one experiment, for example, Hansen and Graham (1991) compared the effects of "normative education" (a norm correction intervention), resistance skill training, and no intervention on the alcohol, marijuana, and tobacco

use of junior high school students in Los Angeles. The normative education program provided accurate information about prevalence and acceptability of use among peers. One year after the intervention, there were significant main effects of this intervention for all dependent measures. There were no significant effects of the resistance skill training. In another study, Haines, Barker and Rice (2003) reported significant decreases in alcohol and tobacco use and increases in accurate perceptions of their use after the implementation of a social norms media campaign in two high schools.

Indeed, this approach has gathered so much support among higher education institutions that social norms campaigns to curb students' alcohol abuse have been adopted by nearly half of all colleges and universities in the United States (Cameron & Campo, 2006). The efficacy of the approach has become more qualified as evidence has amassed. For example, recent research indicates that the "framing" (positive or negative framing) of norm correction messages can influence their effectiveness (Rothman & Salovey, 1997; Prentice, 2008). By and large, however, norm correction interventions provide a sound and well-evidenced approach to remediating some types of negative beliefs and behaviors in adolescents (NSNI, 2010b).

My Intervention. The computer-based reading intervention that is the focus of my research attempts to correct misperceptions of reading norms through videotaped peer modeling of reading comprehension strategies. By leveraging positive peer influence to support reading comprehension, it builds upon Social Norms Theory in a slightly different way than the risky behavior interventions that comprise the bulk of this literature.

In the case of adolescent literacy, I posit that struggling readers *misperceive the dispersal* of reading comprehension among their peers. In other words, they over-estimate the uniformity

of their peers with regard to reading comprehension—believing that everyone else understands much more than they do and that they are alone or nearly so in their confusion about texts.

By asking their own questions, the peer models in my reading intervention communicated they did not completely understand the information in the texts or, in some cases, that they were truly confused by the texts. In doing so, they also *conveyed norm-correcting information* to the struggling reader: They indicated that there is much more variability in the extent to which other students understand the texts.

Based on Social Norms Theory, one would expect the young people in my study to express positive affect once their misperceptions of social norms around reading comprehension have been corrected, and they realize they are not alone in their confusion. Furthermore, one would expect them to engage in more strategic reading behaviors (in this case, making use of the question generation strategy they had been taught) once they realize that they are not so unlike other adolescents and are, indeed, capable of improving their reading comprehension.

Locating My Research on the Road Map of Reading Comprehension

Reading comprehension is one of the most important cognitive skills that young people will acquire during their schooling, and the foundation for much of learning later in life (Mason, 2004). Though comprehension may be conceptualized in a number of ways, Kintsch's (1998) Construction-Integration Theory informs the assumptions that underlie my work.

Theories of Reading Comprehension

The Construction-Integration Model posits two phases of comprehension: The *Construction Phase*, in which ideas from the text are extracted and activated, and the *Integration Phase*, in which these ideas are integrated with prior knowledge and beliefs. Both of these

accentuate the *active nature* of reading, i.e., that reading is a process in which readers actively build a personalized representation of a text in their memory. This personalized representation necessarily includes information from the text but it also includes prior knowledge, experiences, and areas of interest that that the reader integrates with textual material. The model also specifies that the *ultimate outcome of reading comprehension is a coherent, accurate and actionable representation* of a text in one's memory.

Coherence and accuracy require that the reader first grasp the meaning of a text at its most basic level. At this *text-base level*, readers decode words and identify word meanings. They perceive how individual words conjoin to form idea units or propositions. Finally, they make inferences about the *macrostructure* of the text – about the higher-order units (e.g., themes and main concepts and how they are inter-related) around which the text is organized.

If a reader has processed the text in these ways, she will have formed a representation of the *textbase* (the underlying structure that the author has intended) and will likely be able to recall its information. However, she may still lack a deep understanding of the text, and therefore be unable to apply and extend the concepts about which she has read. Additionally, her knowledge of the text may be somewhat piecemeal. To thoroughly comprehend a text, readers must also construct a *situation-model* that integrates their prior knowledge (acquired through direct or vicarious experience) with their understanding of the text.

My research is targeted primarily at the levels of macrostructure and situation model—of constructing inferences and integrating knowledge. It investigated an alternative approach to engaging struggling readers in texts and to facilitating their deep-level comprehension.

Dimensions of Reading Comprehension

In 2002, the Rand Reading Study Group (RRSG) released a report that provided guidelines for a national program to improve reading comprehension. The report also offered a useful framework for thinking about the elements or dimensions involved in reading comprehension (RRSG, 2002). These elements are:

- ***The Reader.*** Individual characteristics that affect reading comprehension include cognitive capacities (attention, memory, inferencing and analytic abilities), reading skills (decoding, fluency), motivation (interest, self-efficacy), knowledge (prior knowledge, domain knowledge, vocabulary knowledge, and knowledge of reading comprehension strategies).
- ***The Text.*** Text characteristics include genre, structure, familiarity of content, readability, linearity or non-linearity (of particular interest with regard to computer-based texts), and complexity.
- ***The Activity.*** Activities are defined by their purposes and goals, the ways they organize participants and the roles they offer to participants, and the ways they promote self-regulated learning.
- ***The Context.*** The largest of the framing elements, context may include in-school versus out-of-school environment and school culture. It may also include larger socio-cultural phenomena such as a child's ethnicity, economic circumstances, and social class.

Each of these elements represents sources of variability in reading comprehension and *sources of opportunity* for effective interventions. Furthermore, the interrelations among these

dimensions may provide critical insights for building more effective interventions and lasting results on literacy.

Reading interventions define context in different ways (by location or socio-economic resources), and some disregard its effects entirely. However, my research considers the contexts of adolescence and of struggle as being essential to supporting struggling adolescent readers. Beyond this, my study on the effects of peer modeling/ influence on adolescents' reading comprehension and motivation stands at a particular intersection of three other elements. Figure 1 illustrates this relationship.

The Context. In the area of adolescent literacy, it is imperative to consider the developmental and social contexts of adolescence. This is the starting point for my research. Adolescence is marked not only by shifts in physiology and cognitive capacities, but also by changes in social relations, goals and influence structures. Peers and social comparison processes become more salient. I argue that social modeling (observational learning) and peer influence (social norms correction) can leverage these natural features of adolescence to create effective more reading comprehension instruction.

Additionally, my research focuses on *struggling* adolescent readers – students whose reading comprehension has been judged to be below acceptable levels for their grade level. Therefore, another important context for many of these children is a history of failure at reading. The motivational consequences of such histories are discussed later in this chapter.

The Activity. My research involves computer-based, asynchronous peer-assisted strategy instruction and reading. Participants engage in two computer-based activities during the study. In the first activity, which takes about 10 minutes, students complete an interactive strategy training module. This module teaches them to use a particular type of question-generation

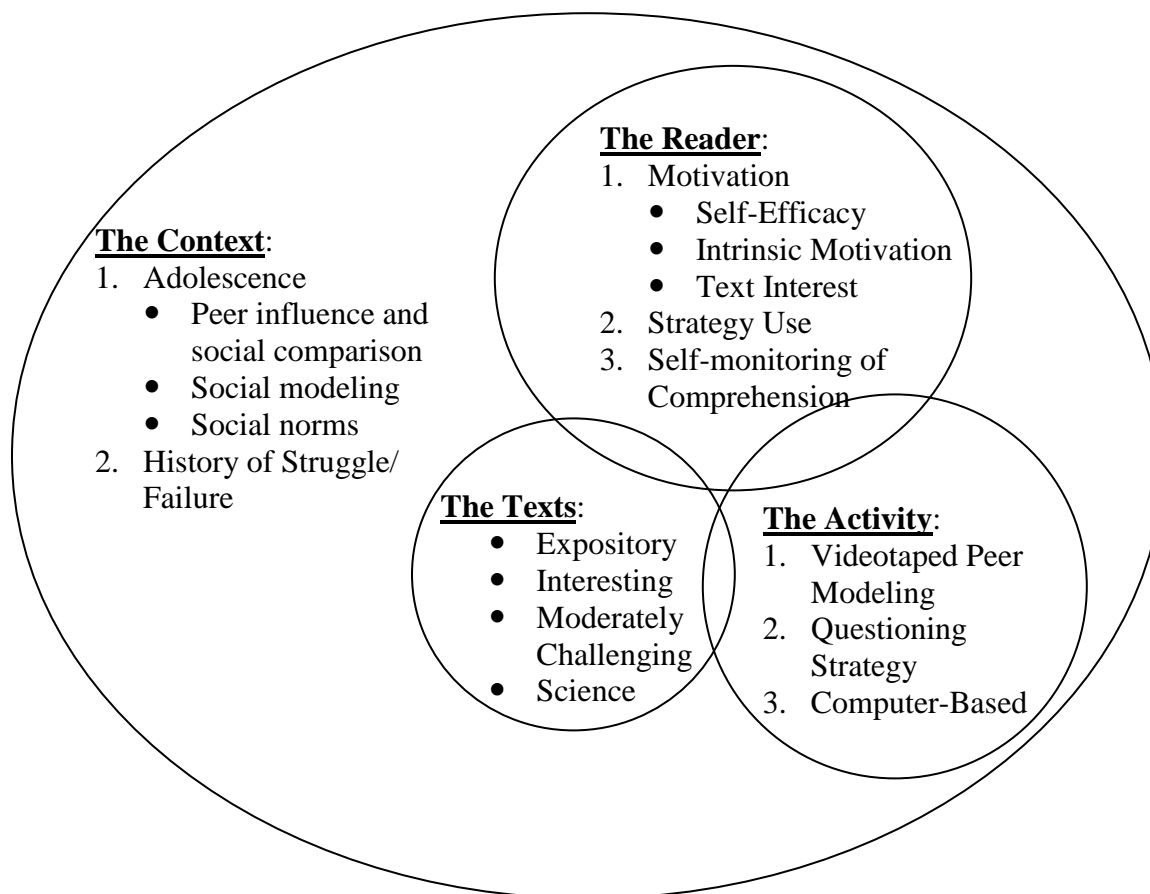
strategy and gives them opportunities to practice the strategy and receive feedback. The questioning strategy focuses on three types of questions—Think & Search, I Wonder, and I'm Confused – that promote activation of prior knowledge, searching for information, and elaborative and causal inferencing.

In the second activity, participants read a supported eText within a different computer-based environment. During reading, participants in the treatment group are exposed to peer modeling. In particular, they view embedded videoclips of peer models asking authentic questions and demonstrating the strategy and then are prompted to ask their own questions. In the Control condition, participants are merely prompted to ask their own questions.

The Texts. Expository texts are the staple of classes for middle- and high-school students. They are also more difficult to understand than narrative texts and demand a higher level of motivation. My research makes use of moderately interesting, expository science texts with problem-solution text structures.

The Reader. The middle-school students involved in my research are those who read at grade-level or one to two levels below grade-level. Struggling readers are often low in motivation as well as being low in a number of reading processes tied to reading comprehension (e.g., vocabulary knowledge, fluency, and strategy use). To the extent they are similar to same-age peers, these youth are likely to have an moderately high levels of facility with and interest in computer technologies.

Figure 1: Current Study as related to RRSR Reading Comprehension Framework



Addressing Cognitive Aspects of Reading Comprehension:

Strategy Instruction and Question-Generation

Strategy Instruction

Comprehension strategies are conscious, intentional, adaptable guides that readers use to help them understand texts. Contrasted with skills which tend to be more routinized, strategies involve reflective use (Pressley, Johnson, Symons, McGoldrick & Kurita, 1989). In general, they help break through passivity and direct readers' attention to cognitive processes that they may modify and strengthen to improve their understanding of texts.

Strategy use is thought to be more readily trainable than other person-level characteristics that influence reading comprehension (e.g., prior knowledge and working memory). As such, over the last 25 years, researchers and educators have invested much effort in developing programs of strategy instruction for reading comprehension

The effort seems warranted: Scores of research studies have confirmed the value of explicit strategy instruction for improving children's reading (Block, Gambrell & Pressley, 2002; Duke & Pearson, 2008-09; Gersten, Fuchs, Williams & Baker, 2001; McKeown, Beck, & Blake, 2009; NICHD, 2000; Rosenshine, Meister, & Chapman, 1996). Furthermore, research has indicated that children with reading-skill deficiencies (lower-achievers) as well as children who are adequate decoders but poor comprehenders may especially benefit from strategy instruction (Dole, Brown, & Trathen, 1996; Duffy et al., 1987; Johnson-Glenberg, 2000; Palincsar & Brown, 1984).

In its review of the research on strategy instruction, the National Reading Panel (NRP) identified seven strategies with solid track records of effectiveness: comprehension monitoring, cooperative learning, question generation, question answering, summarization, story structure, graphic and semantic organizers (NICHD, 2000). Building upon this work, others have advised a balanced approach to reading comprehension instruction that includes the use of multiple strategies along with ample time for reading, writing and discussion of texts (Duke & Pearson, 2008-09). I see my intervention and research as part of this balance.

My study employs question-generation strategy instruction implemented through a peer-assisted, computer-based learning environment. It is an approach that combines cognitive and motivational support for reading comprehension and one that may be particularly effective in less-structured learning environments (after-school programs, extended day instructional periods,

and home learning settings) and with students who tend to disengage during typical, teacher-led types of reading instruction.

Question Generation

Question generation is the act of composing questions about a text during or after reading it. There are several mechanisms by which it is thought to improve reading comprehension.

- It focuses the reader's attention on the content of the text and helps the reader to engage in inspecting the text, combining information in the text, integrating prior knowledge related to the text, and judging the sensibility of inferences.
- It supports the reader in maintaining an active stance for the duration of reading (Sinatra, Brown, & Reynolds, 2002).
- It may stimulate inferencing and explanation—behaviors that, themselves, are associated with enhanced comprehension (King & Rosenshine, 1993).
- It may sensitize readers to what they do not understand from the text. Such comprehension monitoring may then lead students to try to repair or resolve problems of understanding (Palincsar & Brown, 1984; Rosenshine et al., 1996).
- It may help the reader link the new material to everyday concepts, thereby creating a more situated representation of this content in memory (King, Staffieri, Adelgais, 1998).

There is ample evidence that question generation improves students' comprehension and learning (Graesser, Singer, & Trabasso, 1994; Pressley, McDaniel, Turnure, Wood, & Ahmad, 1987; Rosenshine et al., 1996; Seiffert, 1993). For example, in a review of 26 research studies that investigated the effects of question-generation on children's comprehension and transfer,

Rosenshine, Meister, & Chapman (1996) found substantial and significant effect sizes. The median effect size for experimenter-developed tests was $ES=0.86$ (81st percentile) and $ES=0.36$ (64th percentile) for standardized tests. Additionally, the authors observed somewhat more positive and pronounced effects for students who were near grade level in decoding but poor in comprehension, i.e., students who may have trouble at the macrostructure and situation model levels of comprehension.

Many programs have been designed to teach young people to ask themselves questions to improve text comprehension. There are approaches that focus exclusively on question-generation strategy instruction (Davey & McBride, 1986; King, 1994; King, 2002; Rafael & Pearson, 1985; Rafael & Au, 2005; Wong & Jones, 1982). Likewise, there are interventions that incorporate question generation into a wider, multi-component program of strategy instruction, such as Palincsar & Brown's (1984) *Reciprocal Teaching* approach, Beck, McKeown, Sandora, Kucan, & Worthy's (1996) *Questioning the Author* approach, and Klinger, Vaughn, & Schumm's (1998) *Collaborative Strategic Reading* approach. Finally, there are those interventions that teach question asking as part of peer tutoring processes (Graesser & Person, 1994; Roscoe & Chi, 2007) or classroom discussion practices (Chinn, O'Donnell, Jinks, 2000).

Regardless of whether they are the sole focus of a strategy instruction program or merely one component, question-generation strategies also differ in effectiveness. Three aspects of question-generation strategy instruction are particularly important to effectiveness. These are:

- (1) Question content
- (2) Amount of structure or guidance that is provided to learners in the form of
“procedural prompts”
- (3) Method by which students learn to ask themselves questions.

Question Content

Higher- and lower-order questions. Much of the past research around question asking in educational settings has focused on the distinction between *higher-* and *lower-order* or *deep-* and *shallow-reasoning* questions. Lower-order or shallow-reasoning questions are distinguished by the types of responses they elicit. In general, these questions invite single word or very short answers. In contrast, deep-reasoning or higher-order questions are characterized by the *patterns of thinking* they elicit. Such questions involve integrating new and prior knowledge, reorganizing mental models, generating inferences, and monitoring comprehension. Examples are questions involving comparisons and contrasts, application of concepts to new situations, mechanisms and motives for action, and causality (Dillon, 1984; Graesser & Person, 1994; Roscoe & Chi, 2007).

Prevalence. It is well-documented that the frequency and sophistication of students' question asking is very low in typical learning environments. Within classrooms, the median number of student questions per hour hovers around 3.0, averaging out to approximately 0.11 question per student per hour (Graesser & Person, 1994). Furthermore, the number of questions students ask seems to be reasonably constant across all grade levels (Good, Slavings, Harel, Emerson, 1987).

In tutoring sessions, the number of questions that students ask is markedly higher. For instance, Graesser & Person (1994) found that among seventh graders in an algebra tutoring setting, the mean number of student questions per hour was 32.2. Among college students in a research methods tutoring setting, the mean number of questions was 21.1. However, in both cases, the students were not likely to ask many deep-reasoning questions. Instead, they tended to ask verification questions (those probing whether something was true or really occurred),

instrument-procedural questions (what plan needs to be followed to reach the goal), and concept completion (who and what) questions.

Barriers to question asking. There are many reasons why students do not ask questions in typical learning environments. On a metacognitive level, students often have trouble identifying their own knowledge deficits. On a social level, question asking demands considerable ego resilience, as students risk a loss of status when they “reveal ignorance” or ask a “bad” question. On a cognitive level, students often do not have good question-asking skills because they lack good role models to demonstrate the techniques (Graesser & Person, 1994; van der Meij, 1998).

Additionally, lower-achieving students may be *socialized not to ask questions* in typical classrooms. Good et al. (1987) describe how first-grade students in low- versus high-ability groups developed different norms for participating in class discussions over time. They also discuss how certain teacher practices may induce passivity among lower-achieving students. In a cross-sectional study of students’ question asking in 22 classrooms at seven different K-12 grade levels, the authors find trends in which achievement level is related to question asking. Their data suggest that lower-achieving students, in comparison with higher achievers, ask fewer questions in general and fewer academic questions in particular (those involving explanation, information clarification, and non-task curiosity) as they get older.

My intervention. My instructional approach attempts to foster students’ higher-order question generation by directly addressing the barriers identified above. Peer models are employed to demonstrate techniques of question-asking as well as to communicate positive norms and appropriate standards.

Elaborative Interrogation. Research on question content in educational interventions has taken many forms. One important line of research has focused on the use of “why” questions or “elaborative interrogation” (EI) to support reading comprehension. While its name suggests that this strategy would involve question generation, in fact EI has largely been operationalized as *answering rather than asking* “why” questions during reading: The “why” questions in this research are generated by researchers or curriculum developers. This strategy does have large effects on memory for text (Pressley, McDaniel, Turnure, Wood & Ahmad, 1987; Seifert, 1993). However, its effects on deeper-level comprehension and inferencing are less clear-cut.

For example, in a study of sixth and seventh graders, Seifert (1993) found that students who were instructed to answer a why question for each paragraph (this question was provided by the researcher) were better able to recall main ideas than students who were instructed to simply underline important information in the text. Additionally, they were better able to match target facts with larger principles. However, students in the EI condition were no better at inferencing than students in the control condition. Furthermore, the quality of students’ elaborations (answers to the presented “why” questions) was not associated with benefits of using the strategy. Most dramatically, providing an answer to the question was not statistically different from providing no response to the question. Importantly, this study examined students’ use of the strategies with longer, expository passages; materials consisted of three, six-paragraph passages. Earlier research mostly employed single sentences or short paragraphs.

Similarly, Callender & McDaniel (2007) conducted a study with university students who were characterized as low- and high-comprehenders. The authors assigned students in each comprehension group to one of three reading conditions—EI, embedded questions and reading the passage twice. Whereas using an EI strategy improved lower comprehenders’ recall of text-

explicit information, it did not improve the coherence of representations for either the low- or high-comprehenders.

In contrast, in another study with college students, Ozgungor & Guthrie (2004) found that elaborative interrogation improved not only recall but also the coherence of the readers' representations and their likelihood of drawing accurate inferences from the text. Notably, both prior knowledge and interest were considered in this experimental design. Elaborative interrogation was found to be particularly beneficial for students who had less interest and less prior knowledge in the content of the text.

My intervention. While my research prioritizes question asking, rather than question answering, it does recognize the value of “why” questions. The strategy instruction in my study encourages students to ask “why” questions in the context of either “wondering” about a phenomenon or expressing “confusion” about contradictions they notice. My research also builds upon insights derived from EI research. Namely, this work has elucidated the roles of both *activating* relevant knowledge and *inhibiting* irrelevant information in building accurate representations and comprehending text. There is evidence that poor comprehenders may have limitations in both of these processes (Callender & McDaniel, 2007; Trabasso & Suh, 1993; Williams, 1993). While one would expect my peer modeling intervention to promote activation of relevant knowledge, it is not clear what effect this approach will have on inhibiting irrelevant information.

Sources of Information/Processes for Answering Questions. Another of inquiry around questioning has focused on the sources of information or processes that students employ to answer their own questions. Three sources of information or processing components are commonly acknowledged: (1) the explicit text; (2) the reader's knowledge about the content of

the text; and (3) the reader's knowledge of the pragmatics of communication and devices that authors may use to communicate their ideas and purpose for writing (Otero & Graesser, 2001).

Building on this framework, Rafael and her colleagues designed a type of strategy instruction known as Question-Answer Relations (QARs) and conducted a program of research around it. In this approach, children were taught to distinguish among three types of question-answer relationships (corresponding to the task demands of the question) and then to answer questions in each category (Rafael & Au, 2005; Rafael & Pearson, 1985; Rafael & Wonnacott, 1985).

- Text-explicit (TE) relations are ones in which the text of a question and the answer to this question were found within a single sentence. No inferencing is required. Using a "Right There" mnemonic, young readers in Rafael's intervention studies were encouraged to simply inspect the text carefully to find answers to TE types of questions.
- Text-implicit (TI) relations are ones in which answer information is available in the text, but readers must combine information across sentences and paragraphs to draw the necessary inferences. The memory cue that students were taught for these questions was "Think and Search."
- Script-implicit (SI) question-answer relations are those in which the text does not contain the information necessary to answer the question and readers must fill in or acquire information to answer them. For these relations, students were taught the mnemonic of "On my Own," meaning they had to find the answers on their own.

In a training study with sixth graders, Rafael and Pearson (1985) taught the low-, average- and high-ability students this QARs strategy. They then presented both treatment and

control groups with medium-length expository texts and questions. Children were asked to identify the type of each kind of question and then to answer it. The researchers investigated the number of hits or correct identifications of QAR as well as the quality of response and the match between the way the children classified the question and the way they answered it. When assessing differences on the quality of responses, they specifically examined differences between TI and TE questions and TI and SI questions for all three ability groups in each condition.

As expected, the authors found that strategy training increased children's ability to accurately judge the source of information needed to answer questions and the task-demands of the questions (hits). Additionally, training significantly improved the quality of students' answers to questions. For low-ability students, however, this improvement was only manifest on text-based (TE and TI) questions, not on knowledge-based questions.

Three explanations were offered for these results. Firstly, for all ability groups, the text-based prompts may have encouraged more frequent look-backs, and this in turn, may have resulted in better text processing. Secondly, for the high-ability group, the SI prompt "Go to my head" may have reminded them to apply prior knowledge at these moments. However, for lower-ability students, this prompt was not sufficient. Finally, for all students, understanding the explicit task demands of questions may have helped them answer them more appropriately.

Later QARs research (Rafael & Au, 2005) included a fourth type of question-answer relation, "Author and Me," which directs readers' attention to the author's purpose in writing a text. This type of question prompts learners to make predictions, distinguish facts from opinions, and make inferences. Furthermore, as students internalize these QARs types and question exemplars across multiple types, they are expected to begin asking themselves questions at some point.

Overall, though, in this method, answering questions accurately and completely is the benchmark of comprehension. As such, the basis of this work is to help children *answer* questions better. Questions are posed by an authority, such as the teacher or the text materials, and children answer them. The focus of QARs training is *not* to help young readers *ask* better questions in order to attain greater comprehension.

My intervention. Again, my research and strategy instruction are premised on the contention that *asking* quality questions is both a hallmark of good comprehension and a pathway to it. Therefore, my work focuses on teaching students to ask their own good questions rather than answering those posed by external authorities. Furthermore, my pilot research with early adolescents indicated that when encouraged to articulate their own questions, they usually asked SI questions and rarely asked TE questions.

Nonetheless, my research has been informed by the question-type procedural prompts favored by Rafael and colleagues as well as the group's emphasis on the sources of information required to answer different types of questions.

Amount of Structure Provided in Question-Generation Strategy Instruction

It is widely understood that to best promote higher-order thinking and learning, educators must provide the “right amount” of structure. Too much structure may hamper students' active search for meaning in the material. Too little structure may encourage them to take the easy way out and interact with text at a very basic, knowledge-retelling level (King et al, 1998).

Within question-generation strategy instruction, structure is often provided through *procedural prompts*. These are guides for asking questions. Rosenshine et al. (1996) identify

five types of procedural prompts that have been featured in question-generation training. From most- to least-structured, these prompts are:

- *Generic Question Stem and Generic Questions*, such as “How are ___ and ___ alike?”, “Why is ___ better than ___?”, and “What is a new example of ___?”
- *Story Grammar*, in which students are asked to generate questions about specific elements of narrative texts, such as a character’s goals and obstacles
- *Main Idea focus*, which involves identifying of the main idea and then developing a series of questions around it
- *Signal Words*, such as who, what, why, when, how
- *Question Types*, in which types of questions are explained, and students develop and categorize their own questions accordingly

The assumption underlying the most structured procedural prompts (highly elaborated question stems) is that the question stems themselves create a logical way of thinking about texts and are responsible for most of the learning that students will derive from questioning (King & Rosenshine, 1993). Question asking, in such cases, is primarily about the learner applying certain patterns of logic to the text. Each type of question stem has its own logic. For example, stems such as “What is the significance of...” and “Explain how...” promote critical thinking; “How does ... affect ...” promotes analysis; “What do you think would happen if...” prompts for prediction.

In a study of “normally-achieving” fifth graders, King & Rosenshine (1993) examined the reading performance of students who received question-generation training in the form of elaborated question stems compared with those who received training in the form of signal words and those in an unguided questioning condition. Comprehension was assessed at two points in

time. Immediately after the task, a 12-item posttest was administered that contained multiple-choice and open-ended questions and measured both literal comprehension and inferencing. Six days later, the same test was administered as a “delayed” post. Additionally, knowledge maps were used as a method for assessing students’ representation of the content.

The results from the study showed an interesting pattern. Students in the elaborated question-stem condition outperformed all others on both the immediate post-test and the knowledge map. However, there were no significant post-test differences on inferencing items for students receiving generic question stem training versus those receiving signal word training. Furthermore, on the retention test, there were no differences at all between students in these two conditions.

Clearly there is value to structured prompts and to providing learners with examples of a variety of types of questions they may ask to interrogate a text. At the same time, there is evidence that allowing learners to ask their own questions results in significant positive effects on learning (King, 1994). Additionally, it is not apparent that such domain-independent question stems lead to higher-order thinking for *lower-achieving* readers. Nor is it clear that this type of approach can sustain the motivation of struggling readers.

My intervention. My approach involves a moderate amount of structure provided in the form of three question types—Think & Search, I Wonder, and I’m Confused questions. Within each of these categories, peer models ask various kinds of authentic, unscripted, and “situated” questions. For example, in a passage about the John Hancock Building, peer models ask “Is the John Hancock Building taller than the Empire State Building?” While this is a comparison question, it is quite different than those derived from the generic question stem, “How are ... and ... alike?”

For struggling readers, in particular, these concrete, situated types of question may offer better support for comprehension, as they may represent a more appropriate Zone of Proximal Development (Vygotsky, 1978).

Peer-Assisted Strategy Instruction

Peer-assisted learning is the acquisition of knowledge or skill through active helping and supporting among people who are equal in standing or status (Topping, 2001). In this approach, people who are not professional educators in a domain help each other learn. Peer-assisted learning may be implemented in a number of different ways: Common arrangements include peer teaching, peer tutoring, reciprocal teaching, paired learning, cooperative learning, small group learning, class-wide peer tutoring, and ambient peer learning.

Important Features. Peer interactions in each of these arrangements may be characterized by certain key features. These features influence the types of outcomes students achieve through their participation in peer assisted learning. Key implementation variables are:

- ***Characteristics of learners.*** Ability level, age, minority status, and relative socioeconomic status (SES) of learners have been shown to moderate effects of peer assisted learning interventions (Ginsburg-Block, Rohrbeck & Fantuzzo, 2006; Rohrbeck, Ginsburg-Block, Fantuzzo & Miller, 2003; Topping, 2005).
- ***Duration of peer assisted learning programs***
- ***Nature of students' interactions.*** Effects of peer assisted learning programs can differ based on whether peer interactions are structured as same-age or cross-age, same-gender or cross-gender, and dyadic or multi-person (Rohrbeck et al., 2003; Roscoe & Chi, 2007; Topping, 2005).

- ***Role configuration.*** Within dyadic peer learning arrangements, students may be assigned specific roles. Asymmetric-fixed roles are those in which a higher-performing student is paired with a lower-performing one in a tutor-tutee relationship; asymmetric-reciprocal roles are those in which participants who differ in achievement level switch roles through the course of the interaction such that each assumes roles of both tutor and tutee; symmetric-reciprocal roles are those in which same ability peers are paired and take turns at the tutor and tutee roles according to some prescribed schedule. There is evidence that role configuration affects learning outcomes (Roscoe & Chi, 2007).
- ***Training.*** The extent to which peer tutors or helpers are trained and the type of training they receive impacts their effectiveness in some peer assisted learning arrangements. For example, Roscoe & Chi (2007) found that training tutors to use constructivist learning theories led to more pronounced learning gains.
- ***Helping technique.*** Interactions may vary in nature and specificity of how peers help each other. They may engage in drill and practice activities, monitoring and assessment activities, modeling and instruction, providing feedback, or knowledge-building vs. knowledge-telling (McMaster, Fuchs & Fuchs, 2006; Roscoe & Chi, 2007; Topping, 2005). In a detailed study of cross-age peer tutoring involving struggling readers at the college and first grade levels, Juel (1996) found that two types of interactions were especially important in successful dyads: (a) scaffolding of reading and writing, and (b) modeling of how to read and spell unknown words. Furthermore, when tutors used texts that gradually and repetitively introduced both

high-frequency vocabulary and words with common spelling patterns and when they engaged children in direct letter-sound instruction, gains were greater.

- ***Reinforcement or reward contingencies.*** Research indicates that interdependent reward contingencies, those that reward both individual and group efforts, are more associated with learning gains than independent or dependent ones (Rohrbeck et al., 2003; Topping, 2005).
- ***Autonomy and choice.*** When students are able to select or manage goal-setting, monitoring progress, and rewards, gains from peer assisted learning are enhanced (Rohrbeck et al., 2003; Topping, 2005).
- ***Social structure of knowledge building.*** Parr & Townsend (2002) categorize peer learning environments according to the degree which knowledge is socially constructed versus structured through specified materials and procedures. On one end of the continuum is peer tutoring, on the other end is ambient (often spontaneous) peer interaction. The mechanisms by which they impact learning are thought to be quite different.

Finally, most peer learning interventions are carried out in synchronous, face-to-face contexts in which peers interact directly and simultaneously with one another. With the advent of on-line technologies, some research has begun to address the impact of *remote, asynchronous interactions* on learning in peer assisted instruction. However, at this point, very little is known about this issue.

Outcomes related to Peer-Assisted Learning. Peer learning is associated with enhanced academic achievement (Rohrbeck et al., 2003; Topping, 2005), more positive social and self-concept development (Ginsburg-Block et. al, 2006), increased communication skills

(Topping, 2005), strategy use (Spörer & Brunstein, 2009), and improved reading comprehension (Rohrbeck et al., 2003; Spörer & Brunstein, 2009). In a meta-analysis of 90 studies of peer learning, Rohrbeck and her colleagues (2003) found a weak but positive and highly significant effect on elementary school students' reading achievements ($d = .26$) favoring peer-assisted learning over alternative instructional methods. Effects were greater for urban, low-income, and minority students.

Mechanisms of influence. Over 30 years of research has been conducted on peer assisted learning (Topping, 2005). This work has suggested multiple pathways by which peers can affect each others' learning. Social and motivational mechanisms appear to be central to the effectiveness of peer-assisted learning. Peers can model enthusiasm, competence and possibility of success, thereby inducing the same in their learning companions (Ginsburg-Block et al., 2006). They can promote autonomy and self-referenced standards for success (Rohrbeck et al., 2003) and provide support and encouragement (Fuchs, Fuchs, Mathes, & Simmons, 1997). Finally, they can serve as a source of co-regulation, coaching their companions onto greater self-regulation (Spörer & Brunstein, 2009).

In a meta-analysis of 36 studies, Ginsburg-Block et al. (2006) reviewed the effects of peer-assisted learning on elementary students' social outcomes (sociability and competencies related to cooperation, negotiation, consensus building, conflict resolution, helping behaviors, and acceptance of diversity) and self-concept outcomes (feelings about their competence as well as academic self-concept). They also examined how such non-academic effects related to gains in academic performance.

For both social skills and self-concept outcomes, the unweighted mean effect sizes were moderate ($ES = 0.52$, $SD = 0.58$ and $ES = 0.40$, $SD = 0.51$ respectively). These results indicated that

students in the peer assisted learning conditions performed about half a standard deviation better than their peers in control conditions. Furthermore, the correlation with academic achievement was positive and significant for both social skills ($r=.59$, $p=.01$) and self-concept ($r=.57$, $p=.05$). As with academic gains, peer-assisted learning interventions appeared to be more effective for low-income, urban, and minority students.

In addition to social and motivational mechanisms of influence, peer-assisted learning can improve cognitive aspects of academic performance by providing immediate corrective feedback on the accuracy and relevance of contributions. Peer learning companions can further individualize learning and, through increased communication, provide each other more opportunities to restructure and articulate knowledge (Fuchs et al, 1997; Topping, 2005).

Review of Selected Peer-Assisted Strategy Instruction Programs

In the following pages, I offer a brief review of four well-known, peer-assisted strategy instruction programs that aim to improve reading comprehension and that are relevant to my approach. These are Peer Assisted Learning Strategies (PALS), Reciprocal Teaching (RT) and its descendant, Collaborative Strategic Reading (CSR), and Guided Questioning through the ASK to THINK, TEL-WHY approach.

Peer Assisted Learning Strategies. PALS is one of the most well-known and well-researched peer learning programs for reading fluency and comprehension (Fuchs, Fuchs, & Burish, 2000; McMaster, Fuchs, & Fuchs, 2006). It consists of a set of structured activities that involve three types of reading activities designed to promote different reading skills and strategies. “Partner Reading” supports fluency and decoding; “Paragraph Shrinking” promotes main idea identification and summarization; and “Prediction Relay” promotes prediction and

self-monitoring of comprehension. Teaching students to ask questions is *not* an explicit part of this approach.

Nature of peer interactions. PALS uses an asymmetric, reciprocal approach to structuring student interactions, in which higher- and lower-performing students are paired. The higher-level students first serve as the “tutors.” However, the roles are reciprocal such that, during a session, both students serve in the roles of both tutor and tutee. The students are trained to use specific prompts, corrections, and feedback within each reading activity. While students have some degree of autonomy in managing goals and monitoring success, these processes are largely specified by the structure of the activity.

Student outcomes. Nearly 15 years of research has documented that PALS can positively impact the reading achievement of a variety of students (McMaster et al., 2006). Though most of the research on this approach has been conducted with elementary students, it is compelling.

For example, in a large-scale experiment with students in grades 2 through 6, Fuchs et al. (1997) examined the effects of PALS on students in 40 classrooms in twelve urban and suburban elementary and middle schools. Using a stratified procedure to control for student achievement and SES differences, schools were randomly assigned to either implement PALS or to serve as a no-treatment control. 120 target students—one low-performing reader (LP) and one average-achieving (AA) reader per class—were then selected by the teacher. Observational and achievement data were collected for these students.

After 15 weeks of instruction, students at all reading levels (LD, LP, and AA) in PALS classrooms significantly outperformed those in the control classrooms with regards to scores on the Comprehensive Reading Assessment Battery (CRAB), a measure of reading fluency and comprehension consisting of three narrative texts that children read aloud. In the individually-

administered test, children are assessed on words correct (during read-aloud) questions correct (oral responses to short-answer questions), cloze/maze items correct.

Effect sizes, aggregated across all student types, were $ES=.22$, $ES=.55$, and $ES= .56$, respectively, on the words correct, questions correct, and maze choices correct CRAB scores. Furthermore, poor readers benefitted as much from PALS as higher-level readers.

In one of the few PALS studies involving older students, Spörer & Brunstein (2009) employed a pretest posttest experimental design to assess the effects of this approach on the reading comprehension and strategy use of 7th grade students in Germany. Participants were 196 students in eight different classes. Over a 9-week interval, one half of the classes received traditional reading instruction and the other received PALS instruction twice a week.

Students in the PALS condition significantly outperformed those receiving conventional instruction on standardized and experimenter-designed tests of reading comprehension. Additionally, they fared better on tests of strategy use (procedural) and strategy knowledge (declarative) for summarizing—a skill associated with the second PALS reading activity. Finally, students in the PALS classes reported having a more self-regulated approach to reading than their counterparts in the control classes. There were no differences between the experimental groups on strategy use or knowledge for prediction—skills related to the third PALS reading activity.

Reciprocal Teaching and Collaborative Strategic Reading. Palincsar & Brown's (1984) Reciprocal Teaching method is another familiar and celebrated peer-assisted learning strategy instruction program. It is a cooperative group activity that takes place in the form of a dialog about segments of text. This dialog centers around the use of four strategies: summarizing, question generation, clarifying, and predicting. The teacher initially provides

instruction and modeling on the multi-strategy approach. Students gradually assume responsibility for the process by taking turns leading a dialog about the text. The teacher continues to support them, offering feedback, coaching, hints, and explanations.

Collaborative Strategic Reading is an approach built upon RT. It was specifically designed to address three persistent educational problems: (a) how to adequately engage students with disabilities and English language learners in text-based learning, (b) how to teach strategies that facilitate learning from expository texts, and (c) how to provide opportunities for students with disabilities to interact with peers (Klinger & Vaughn, 1999; Klinger, Vaughn, Arguelles, Hughes & Leftwich, 2004). This method repositions three of the original RT strategies and adds a fourth. The reading strategies in this approach are “preview” (prior knowledge activation), “click and chunk” (clarifying and comprehension monitoring), “get the gist” (main idea identification and paraphrasing), and “wrap up” (summarization and question generation).

Nature of peer interactions. Both of these approaches involve *groups* of approximately four students working cooperatively in symmetric and reciprocal roles. The roles correspond to each of the reading strategies promulgated through the method. Enacting these roles (e.g., summarizer, questioner, clarifier, “chunk expert,” “gist pro,” “encourager,” “announcer,” etc.), students engage in a semi-structured dialog with their peers. Students rotate through each of the roles, switching after each paragraph or segment of text. As with PALS, children have a limited degree of choice and autonomy in goal-setting and managing progress and rewards. For the most part, though, they follow a structure that stipulates these aspects of their interactions.

Nature of helping activities. In both RT and CSR, strategies are first taught and modeled by teachers. When students have become proficient, they are placed in cooperative learning groups and given two responsibilities—to complete the assigned task and to make sure that all

other members of their group do likewise. In the groups, students assume the roles described above. Cue cards remind them of what they are to do in their roles.

The questioning strategy in RT is narrowly focused main ideas: Students are encouraged to think about “what main idea question would a teacher or test ask about that section of the text?”(Palincsar & Brown, 1984, p. 122). However, students also ask and answer questions related to clarification, and these may include a number of question types. The questioning strategy in CSR is broader. It employs highly structured procedural prompts (highly elaborated question stems) such as those described in the previous and following sections (Rosenshine, Meister, & Chapman, 1996; Rosenshine & Meister, 1992).

Student outcomes. Reciprocal teaching has been compared with many other forms of reading comprehension instruction, including teacher modeling alone, explicit instruction, daily practice at reading test passages and answering accompanying questions, and training to locate information in order to answer different kinds of comprehension questions. It was found to be a more effective approach in all these cases (Duke & Pearson, 2009). For example, in a review of sixteen studies on reciprocal teaching Rosenshine & Meister (1994), found moderate to large effect sizes. When standardized tests were used to assess comprehension, the median effect size was $ES=.32$ in favor of RT. When experimenter-developed comprehension tests were used, the median effect size was $ES=.88$. The effect sizes were roughly the same for students characterized as good decoders-poor comprehenders and for studies that were conducted by researchers other than Palincsar and Brown. Moore (1988) also found that RT was effective across multiple studies.

Similarly, a number of studies have documented the effectiveness of CSR with elementary and middle-school students (Klinger et al., 2004; Bryant, Vaughn, Linan-Thompson,

Ugel, & Hamff, 2000). In particular, it has been found to boost reading comprehension and content learning with English Language Learners and students with learning disabilities (Klinger et al., 2004).

With both of these approaches, however, researchers have cautioned that outcomes are highly dependent upon the *quality of the discourse* within the cooperative student groups and on the *teacher's level of experience implementing the approach*. Rosenshine & Meister (1994) expressed concern that few of the studies in their meta-analysis included direct observation and evaluation of the quality of the RT dialogs among students, and furthermore, that no criteria had been designed to do so. Using a procedure designed by Mosenthal (1987), researchers examined RT dialogs from studies in which transcripts of student dialogs were provided. Ninety percent of students' questions, but only one third of their summaries, were coded as adequate.

Similarly, in a study of ten elementary classrooms—five implementing CSR and five using a typical approach— Klinger et al.(2004) found wide variability in comprehension gains associated with CSR. Overall, students in the CSR classes showed significantly greater improvement on the Gates-MacGinitie Reading Comprehension Test than students in the control classes, $F(1, 208)=6.39, p=.01, d=.19$. However, gain scores in two of the five CSR classes were on par or substantially lower than those in control classes.

Further reviewing observation data and teacher interviews, the researchers found that in one of these classes, classroom management was the priority. In the other class, the teacher was well-organized and had good classroom management skills, but her objective seemed to be lesson completion rather than fostering high-quality learning dialogs. She focused on lower-level questions and did not encourage students to discuss or extend each others' responses. As a result, students seemed to disengage.

Guided Peer Questioning. Allison King's (1994, 1998, 2002) ASK to THINK–TEL WHY model coaches students to ask thought-provoking questions and to respond with elaborated answers. It relies on structured peer interactions, in which same-age students are paired or placed in small groups and then exchange roles as question-generators and question-answerers.

Nature of peer interactions. In contrast with typical peer tutoring arrangements, the relationship between students in this type of model is symmetric: Each student in the pair takes a turn at asking and answering questions.

Nature of helping activities. The pairs or small groups follow a set protocol and use generic question stems. This approach provides instruction in asking deeper questions (ASK to THINK), providing supportive communication such as actively listening and giving encouraging feedback, and generating elaborated explanations or responses (TEL WHY).

The ASK to THINK portion of King's strategy training separates questioner and explainer roles and employs a deliberate sequence of question types. These types are:

- (1) Review Questions in which peer designated as the "tutor" (questioner) checks on what her partner knows about the text by asking knowledge-review questions. Examples of question stems provided for Review Questions are "What does ___ mean?" and "Describe ___ in your own words."
- (2) Thinking Questions in which the peer tutor prompts the explainer to go beyond the text, integrate information, and observe new patterns of relationships. Examples of question stems for Thinking Questions are "What is the difference between ___ and ___?" and "What do you think would happen if ___?"

Additionally, students are taught to ask two types of questions (Probing Questions and Hints) that support extended discourse. Examples of question stems that prompt children to probe for deeper responses are “What do you mean by ___?” and “Tell me more about ___.”

Student outcomes. In one study of involving one class of 34 normally-achieving fifth graders, King & Rosenshine (1993) compared the post-test reading comprehension and knowledge of students in three conditions: highly elaborated question stems (ASK to THINK), less elaborated question stems (signal words), and unguided peer questioning. Over a two and a half week period, students in each condition participated in seven, 1-hour sessions in which they read the same science texts and used strategy prompt cards with instructions and reminders about questioning that was specific to their condition. Students in the highly elaborated peer questioning condition outperformed those in the unguided peer question on measures of literal and inferential reading comprehension. Furthermore, these students also constructed more coherent knowledge maps than their counterparts in the less elaborated and unguided questioning conditions.

In a subsequent study, King et al. (1998) carried out a very similar experiment but with 54 seventh graders. The students followed procedures similar to those described above. However, they not only questioned each other, they also explained their positions as part of the method. Outcome measures included a posttest, transfer test and 8-week follow-up test for literal (eight items) and inferential (four items) reading comprehension. Additionally, verbal interaction scores were computed. Students in the sequenced inquiry plus explanation condition (SIE) outperformed those in the Inquiry plus Explanation (IE) and the explanation only (E) condition on post-tests of comprehension but not on delayed or transfer tests.

My Intervention. Theoretically, my research continues the work of Ginsburg-Block et al. (2006) by investigating the influences on academic achievement of social, emotional and motivational effects from peer learning. That these effects are particularly pronounced in low-income, minority, urban children is particularly provocative and demands greater attention. My research responds to a challenge posed by these authors to clarify whether social-emotional outcomes serve to mediate the relationship between theoretically based PAL components and student achievement.

Content-wise, my approach is most similar to and draws most heavily on King's research on guided peer questioning. However, rather than highly structured and elaborated question stems, my approach uses question types. Accordingly, some structure is provided, but students are also given a great deal of autonomy in selecting which inquiries to pursue and develop.

Nature of peer interactions. The peer-assisted learning intervention employed in my study involves symmetric, same-age peer encounters. However, it is substantially different from those described above with regard to the nature of peer interactions. In my research, peer models are *not* physically present nor do they explicitly interact with participants. There is no exchange of information between the two. However, they are *socially present*. Through video presentations, peer models offer support, encouragement and they model motivational and cognitive practices related to reading comprehension. As such, my intervention may be more akin to ambient peer-assisted learning interactions (Parr & Townsend, 2003).

The peer models in my intervention are also *not known* to research participants. They are strangers, yet they are similar enough that participants may feel as though they could know them. This particular arrangement of peers may avert some of the social incompatibility problems that teachers often face in placing students in pairs or groups within a classroom.

Nature of helping activities. My study focuses on a single comprehension strategy—question generation—with questions targeted at activating prior knowledge and supporting elaboration, inferencing, and self-monitoring of comprehension. There is no reason, though, that the same technique cannot be applied to multiple strategies, particularly to self-explanation, summarization, and prediction. Indeed, I would expect this to be a natural extension of the work.

In my study, videotaped peer models provide help in the form of questions they ask about specific texts. In the computer-based environment, their questions are positioned as peer support: Prior to the presentation of any models' question, participants are informed that "Here are some examples of questions that other kids have asked about this story. They thought their questions might help you too."

One surprising finding from my pilot research, however, was that participants naturally took on the role of helper as well. After viewing videos from the Peer Modeling/Influence condition, several students reported that they "wanted to help the kids in the videos" find the answers to their questions. They did so not by directly speaking with the children in the videos, but instead by thinking of how they would answer or find the answer to their peers' questions.

Computer-Supported Strategy Instruction

Computers have the potential to support struggling readers in multiple ways. As compensatory tools, they can provide greater access to text, for example through text-to-speech features. As learning tools, they can help students learn to read with understanding, for example by improving their use of effective comprehension strategies (Dalton & Strangman, 2006). By providing individualized, multi-sensory and adaptive instruction as well as motivational support, computers may support readers in developing the necessary skills and habits to succeed at reading (Graesser, 2007).

Two distinct yet complementary approaches have dominated research and development of computer-based interventions to support literacy. These are *Supported eText* and *Intelligent Tutoring Systems*. In recent years, however, both approaches have converged in their incorporation of *simulated social interactions*. These social interactions generally occur between the learner and animated pedagogical agents—animated characters that provide instruction, examples, coaching and assistance (Graesser, Jeon & Dufty, 2008). Issues related to the use of such animated pedagogical agents as strategy coaches are very relevant to my research study and will be highlighted in the following discussion.

Supported eText. The first approach emphasizes the primacy of the text that is to be read and understood. In this framework, all other media and media interactions are considered as supports or enhancements to the text (Horney & Anderson-Inman, 1999; Anderson-Inman & Horney, 2007). Dating back to the early 1980s, the Supported eText approach has examined sets of computer-based functionalities that can help struggling readers as they try to make sense of text. It has also served as a basis for a number of highly successful reading programs, including Tom Snyder Production, Inc.'s *Thinking Reader* (Tom Snyder Productions, Inc., 2005) and the Center for Applied Special Technology's (CAST's) learning tool kit (Proctor, Dalton & Grisham, 2007; Dalton & Strangman, 2006).

Anderson-Inman & Horney (2007) describe eleven different ways that hypermedia texts may be modified or enhanced with computer-based resources. Among the enhancements described in their *Typology of Supported eText Resources* are:

- *Presentational* enhancements enable the text presentation to be customized to meet the needs of various learners.

- *Illustrative* enhancements are visual representations or examples of elements in the text used to extend comprehension.
- *Translational* enhancements provide a one-to-one equivalent or simplified version that is more accessible to readers. The most common examples of translational resources are text-to-speech enhancements and alternate language versions.
- *Explanatory* enhancements consist of additional information that is provided to clarify concepts, processes or events.
- *Enrichment* enhancements include supplementary material that is not necessary to comprehend the text but that contributes to the reader's understanding of its context or appreciation of its importance.
- *Instructional* enhancements provide prompts, strategies or guides to teach aspects of the text or how to interpret it. Included among these are tutorials, embedded prompts, study guides, tips and hints, on-line mentoring, and animated pedagogical agents.
- *Notational* enhancements offer tools for the reader to mark or take notes on the text as well as to store and organize these for later review.
- *Collaborative* enhancements are tools for working with or sharing with other readers or audiences, e.g., on-line discussions, chats, podcasts or blogs.
- *Evaluational* enhancements include quizzes, tests and other forms of assessment.

Universal Literacy Environments. Incorporating many of these supportive eText resources into a cognitive apprenticeship framework, Dalton and her colleagues from CAST (Dalton, Pisha, Eagleton, Coyne & Deysher, 2002; Dalton & Proctor, 2007; Dalton & Strangman, 2006; Proctor & Dalton, 2007) have developed a series of scaffolded, digital multimedia hypertexts they call Universal Literacy Environments (ULEs). These environments

are designed to be used in classroom settings with a teacher present. They provide multiple means of representing texts (including text-to-speech support and multimedia vocabulary and background knowledge hyperlinks), of engagement (including notational tools and self-evaluation prompts), and of strategic learning (embedded strategy instruction).

Adapted from Palincsar & Brown's (1984) Reciprocal Teaching approach, ULEs promote the use of prediction, questioning, clarification, summarization, and visualization strategies. As students read a text, they are periodically prompted to stop and apply a strategy. The prompts are designed to correspond with five levels of support, gradually fading from high support to independent strategy use.

Also available in the system are animated agents that serve as hint or strategy coaches. As they wish, students may click on these characters to obtain generic strategy hints, a think-aloud and model response for a particular strategy, or corrective feedback if they select the wrong response within certain levels of support. Notably, these animated strategy coaches provide monologic verbal support that is based on expert models.

In a recent study, Proctor et. al. (2007) investigated the effects of a ULE containing eight texts, paired narrative-expository texts. Participants in the study were 30 fourth graders (both English Language Learners and English Only students) who were classified by their teachers as struggling readers. Analyses of pre- and post-scores on the Gates-MacGinitie Reading Comprehension Test showed no significant gains related to use of the ULE. However, the use of the animated strategy coaches was positively and significantly correlated with comprehension gains, $r=.41$, $p<.05$. The authors are continuing to examine this finding.

In a previous study, however, Dalton, Pisha, Eagleton, Coyne & Deysler (2002) compared a computer-supported ULE with traditional strategy instruction and found significant

positive effects of the ULE on reading comprehension. Participants in this study were 102 middle-school students in 14 classes who scored at the 25th percentile or lower on the Gates-MacGinitie Reading Comprehension Test at the beginning of the year. After being introduced to strategy instruction, participants in each class read three, age-appropriate novels over a six month period. Approximately twice a week, students in the ULE condition read digitized versions of these novels with embedded strategy prompts and text supports. Students in the Traditional Strategy Instruction group spent the same amount of time reading and applying strategies without the support of the computer environment.

At the end of the intervention period, the Gates-MacGinitie test was again administered. Students in the ULE condition gained approximately 0.53 grade equivalents. In comparison, students in the Traditional Strategy Instruction condition gained 0.2 grade equivalents. The difference between gain scores for the two groups was statistically significant at the $p < .05$ level. The authors attributed this difference to the text enhancements such as text-to-speech features, the embedded strategy prompts and coaches, the accessibility of assessment data (students could easily access a log of their progress in the ULE), and opportunities for students to make choices in the computer-supported environment. In that a basic control group was not included in this study, however, generalizations are limited.

Intelligent Tutoring Systems. The second approach to computer-supported reading strategy instruction grows from a large corpus of literature on effective tutoring practices, not limited to reading instruction (Chi, Siler, Jeong, Yamauchi, & Hausmann, 2001; Graesser, Person, & Magliano, 1995; Shah, Evens, Michael, & Rovick, 2002). This research has identified *conversational patterns*, including types of speech acts and dialogic moves, that are characteristic of effective tutoring. Examples of dialogic moves are feedback, pumps for more

information, hints, prompts, summaries, corrections, and answers to students' questions (Graesser et al., 2008).

Capitalizing on advances in technology, researchers have transferred these conversational patterns to animated pedagogical agents. These agents generally appear as talking heads or full-bodied characters. Acting singularly or in ensembles, they possess a variety of physical features and personality characteristics¹. Animated pedagogical agents interact with students by modeling good practices and strategies and by participating in conversations with them. These conversations are mixed-initiative, such that both the student and the agent may initiate lines of inquiry or talk.

A number of intelligent tutors have been designed, notably at Institute for Intelligent Systems at the University of Memphis and at the Human-Computer Interaction Institute at Carnegie Mellon University. However, two such systems are particularly relevant to this discussion on supporting struggling readers to improve their comprehension: iSTART and iDRIVE. These two systems and corresponding research will be described below.

iSTART. Interactive Strategy Training for Active Reading and Thinking (iSTART) is an intelligent tutoring system designed to help adolescents become better readers by giving them opportunities to learn and practice self-explanation. While constructing explanations about a text, students use strategies such as comprehension monitoring, paraphrasing, inferencing and making predictions (Graesser et. al, 2008; Graesser, McNamara, & VanLehn, 2005; McNamara, O'Reilly, Rowe, Boonthum, & Levinstein, 2007).

In this computer-based learning environment (CBLE), animated pedagogical agents are employed in two different ways. First, in an introductory module, a trio of agents comprised of a

¹ For example, Graesser et. al (2008) describe a pedagogical agent that was designed with a "rude" personality. This agent provided sarcastic feedback to students. Some students preferred learning with this type of partner.

“professor character” and two “student” characters converse among themselves: The professor agent instructs the two student agents and answers their questions. In contrast to the ULEs described above, learners are not directly addressed by the strategy coach in this first module of iSTART. Instead, adolescents learn vicariously by observing other simulated learners. They also take quizzes which assess how well they have apprehended the material.

Similarly, in a *demonstration* module, human learners both observe and participate in interactions with two agents—Merlin, the tutor or instructor, and Genie, the student. McNamara et al. (2007) note that while Genie is “cast as a student,” this character is an “expert self-explainer” most of the time. In this module, Merlin does directly query the learners but in a limited way—asking them to identify and locate the strategies being used.

Finally, in a *practice* module, the *agents interact directly and extensively with the human learners*. Merlin, the tutor agent, provides feedback on learners’ self-explanations based on latent semantic analyses of the learners’ typed-in explanations. His comments vary in content and enthusiasm. For instance, when the learners’ explanations are too short, irrelevant, or too similar to the original sentence, the agent encourages learners to modify them. When learners appear to be having continued difficulty, the Genie character offers assistance.

Evidence on the effectiveness of iSTART at promoting deeper-level comprehension has been mixed. For example, O’Reilly & McNamara’s (2007) study with college students demonstrated that using iSTART enhanced students’ understanding of text-explicit (text-based) information but did not improve their performance on test items related to higher-level inferencing. The authors attributed this result, in part, to the difficulty level of the text they used. Subsequently, they recommended the use of moderately-challenging rather than highly-challenging materials, but they also probed the phenomenon further.

McNamara et al. (2007) found differences in effects of iSTART for high- versus low-strategy knowledge students. For low-strategy students, the effects of using iSTART were more pronounced at the literal, text-based level. High-strategy students, however, showed more pronounced gains on more difficult bridging-inference types of assessment questions.

iDRIVE. Instruction with Deep-level Reasoning questions in Vicarious Environments (iDRIVE) models the asking of deep-level questions in order to help students learn science content. Unlike the other environments that have been discussed in this section, iDRIVE is not interactive. Instead, students learn only by observation: They observe the dialogs between dyads of animated agents, including a tutor and tutee virtual character (Graesser et al, 2008; Gholson & Craig, 2006).

Gholson, Craig and their colleagues at the University of Memphis conducted a series of experiments in which they manipulated the properties of the dialog that students overhear to determine their effects on learning (Craig, Driscoll, & Gholson, 2004; Craig, Sullins, Witherspoon, & Gholson, 2006; Driscoll, Craig, Gholson, Ventura, Hu & Graesser, 2003; Gholson & Craig, 2006). For example, they have varied the number and type of questions (shallow vs. deep-level) that students overhear as well as the context of presentation (monologic vs. dialogic). These experiments have generally involved college students with low domain knowledge who are learning about how computers work and have shown that students who overhear deep-level questions and their answers in a dialogic context outperform others on retention, learning, and transfer tasks.

In one set of experiments, for instance, Craig et al. (2000), cited in Gholson & Craig (2006), used vicarious learning procedures to efficiently induce question asking. In these experiments, college students observed the virtual tutor carry on a dialog with the virtual tutee or

they listened to a monolog by the tutor. In the dialogic conditions, a virtual tutee posed questions to a virtual tutor, and the tutor answered these questions. The dialogic condition was described as a “lively series of conversational exchanges.” In the monolog condition, the virtual tutor “lectured” on the topics. This character used the exact same words, phrases and sentences as were used in the dialogic condition, but his explanations were not prompted by question asking.

After the presentation of information in both conditions, students were asked to complete free-recall assessment items on two of the content modules featured in the presentation. They were then given a transfer task in which the tutor presented them with new information and they were directed to ask their questions of the experimenter who would answer each question. Finally, participants answered two additional free-recall questions related to content in the transfer task.

Participants in the dialogic condition outperformed those in the monologic condition on the number of propositions retained in the free-recall task. While this difference was marginally significant, the effect size (Cohen’s *d*) was 0.44. Additionally, on the transfer task, students who overheard the dialogs generated more questions and significantly more deep-level questions than participants in the monolog condition. Shallow questions were those that elicited simple Yes/No responses, whereas deep-level questions probed matters relating to comparison, interpretation, causality, and procedures.

In another set of experiments, Driscoll et al. (2003) used a counter-balanced, within-subjects design to elucidate the mechanisms for the positive effects of overhearing questions. Possible explanations for these effects included that such questions provided simple repetition of key concepts, or they provided signaling of main ideas (similar to headers in printed text), or that asking questions per se promoted active processing.

The authors compared deep- vs. shallow-level questions in a dialogic context with overhearing similar content in a monologic context. The specifications of dialogic and monologic conditions were the same as in the previous experiment. Similarly, deep- and shallow-level questions were defined in the same way, but in these studies, the virtual tutee asked either one type or the other.

For each task, two free-recall assessment items were administered. Participants' responses to these items were analyzed for number of relevant, related, and irrelevant propositions recorded. Only a main effect of question type was found. Learners in the deep-level/dialogic questioning condition wrote significantly more propositions and more relevant propositions than those in the monolog condition. The absence of any effect for shallow questions (generic tutee contributions) suggested that questioning itself, signaling, and repetition were not plausible explanations for the learning gains related to overhearing question-based dialogs. Instead, the more substantive content of deep-level questions was implicated.

An alternate explanation is that the *lively and authentic exchange* of ideas might have triggered greater attention and deeper processing, thereby supporting learning. Certainly, monologic presentation of information or the artificial asking of simple Yes/No question seems neither authentic or engagement.

This engagement hypothesis was not investigated. However, it may be of particular importance for tasks such as reading comprehension that are much more self-directed, interpretative and ill-structured than the computer-literacy tasks featured in these experiments.

My Intervention. In designing the two computer-based environments employed in my study (the interactive strategy training environment and the Active Reading with Peer Models environment), I have been mindful of the lessons learned from previous research with Supported

eText and Intelligent Tutoring Systems. I have incorporated various presentational, translational, explanatory and instructive text enhancements from Anderson-Inman & Horney's (2007) typology, including vocabulary and text-to-speech support and models of good question asking. Moreover, I have adopted the framework of a *simulated social environment* that is the basis for many contemporary computer-based learning support systems, in particular leveraging the research on vicarious learning in such simulated systems.

However, I have also departed from current trends related to simulating social interactions. Most apparently, I have chosen to use videotaped peer models rather than animated pedagogical agents. I made this decision for two reasons—one theoretical and one practical: (1) Theoretically, I surmised that realistic models with salience and appeal to struggling adolescent readers might improve motivation by activating multiple, enduring motivational pathways. From a motivational standpoint, animated agents might also improve children's motivation by increasing their task interest in a task. However, such effects are likely to be shorter-lived than effects on self-efficacy, intrinsic motivation and perceptions of social norms. (2) Practically, videotaping children and embedding these videos into a computer-based environment is far easier and more accessible to literacy practitioners than programming animated agents. While the latter requires specialized skills and technologies, the former requires skills and technologies that are fairly common among the general public. In imagining the further development of this vicarious approach to supporting reading comprehension, I wanted to allow for the possibility that educators could adapt and apply it for their own purposes.

No less importantly, I chose to position the peer models in my study as *supportive friends* rather than as tutors, which might imply asymmetry and turn off some students. As supportive friends, the models can provide authentic examples of strategy use in a language and form that is

accessible to struggling readers. They do not model “expert” strategy use, but rather good strategy use that may be closer to the zone of proximal development (ZPD) for young people who struggle to comprehend what they read.

Asking versus answering. The goal of this section was to explain why my study focuses on question generation as a way to improve reading comprehension and how my approach fits within the context of existing strategy instruction on question asking. One might question the value of asking questions without answering them: Isn’t it just as or more important for students to get answers to questions as to ask them?

Indeed, much research has documented the positive effects of self-explanation on students’ comprehension and problem-solving (Chi, De Leeuw, Chiu, & LaVancher, 1994). Notably, the process of self-explaining often begins with question asking. In other words, it is the question one asks that triggers explaining and determines the nature and scope of one’s explanation.

Interestingly, the accuracy of one’s explanations seems to have little effect on comprehension. In fact, McNamara (2004) found a positive relationship between *inaccurate* elaborations and comprehension and no relationship between inaccurate bridging inferences and comprehension. This suggests that the key ingredient to improved comprehension may lie less in the quality of learners’ responses and more in the activation of their minds, in the acts of identifying and seeking to clarify or resolve perplexities (Dillon, 1998).

Addressing Motivational Aspects of Reading Comprehension

Motivation in Reading

Reading motivation is defined as an individual's goals and beliefs with regard to reading (Guthrie & Wigfield, 1999). It is multi-faceted. A number of different components and processes of reading motivation have been investigated empirically and shown to positively correlate with and, in some cases, to show contribute causally to comprehension.

- *Intrinsic motivation* refers to a person's involvement with reading for its own satisfactions, rather than for separable consequences (Ryan & Deci, 2000; Guthrie & Wigfield, 2000). Intrinsic motivation has been well-studied in the context of research on reading and has been found to be positively associated with comprehension for some populations. Three facets of intrinsic motivation have been found to be particularly impactful on reading behaviors—curiosity, involvement, and preference for challenge (Guthrie et al., 2004; Wang & Guthrie, 2004).
- *Self-efficacy* refers to a reader's belief in her own capacity to comprehend what she has read and to succeed at reading. In many domains including reading, self-efficacy predicts effort, persistence, choice of tasks and self-regulatory processes such as goal-setting and monitoring (Schunk & Zimmerman, 1997). Self-efficacy need not be extremely high to promote engaged reading behaviors. However, low self-efficacy can be extremely detrimental to reading comprehension, as it may prompt readers to avoid opportunities to read and to improve at reading (Chapman & Tunmer, 2003).
- *Learning-related emotions* are affective states related to learning that have a specific referent and occur in short, intense episodes. They are distinct from "moods" which are longer-lasting and more generalized (Linnenbrink & Pintrich, 2002). They are

associated with task value (Schiefele, 1999), achievement goals (Linnenbrink & Pintrich, 2000), and intrinsic motivation (Guthrie, Van Meter, Hancock, Alao, Anderson & McCann, 1998; Pekrun, Goetz, Titz, & Perry, 2002).

- *Task mastery goals* refer to a reader's intentions about a given text interaction—how well she intends to understand a text. Students with high task mastery goals approach reading with the intention to fully comprehend what they have read and to have it make sense with what they already know. Students with lower task mastery goals are less committed to really understanding what they have read (Guthrie & Wigfield, 2005; Pintrich, 2000).
- *Personal interest* refers to an individual's positive affect associated with topics contained in a text (Guthrie & Wigfield, 2005).
- *Beliefs about reading* are ideas that a reader holds about the value of reading and being an effective reader (Guthrie & Wigfield, 2005)

My intervention is expected to influence self-efficacy for reading, intrinsic motivation, and learning-related emotions.

General and situational motivation. When considering motivational influences on reading behaviors, it is important to distinguish between general and situational motivation (Guthrie & Wigfield, 2000; Schiefele, 1999). General motivation refers to characteristics that are enduring across time and contexts, those that are more trait-like. Situational motivation refers to responses that are prompted by particular characteristics of an activity, text, and/or context.

The relationship between situational and general motivation is not well understood. It is not known, for example whether one's accrual of situationally-motivated experiences definitively produces positive general motivation. There is some evidence, however, that

situational motivation may be more important for lower- versus higher-achieving students (deSousa & Oakhill, 1996).

My intervention is targeted to situational motivation, with the assumption that addressing impediments at this level will open up greater opportunities for learning and will thereby boost students' overall reading motivation and achievement.

Developmental shifts in reading motivation. It is well-documented that children's reading motivation declines as they mature, especially as they progress through the middle-school years. Two explanations have been offered for this phenomenon: One explanation focuses on children's increased capacity to process evaluative feedback and to evaluate themselves against social norms. The second explanation points to instructional practices and contexts that amplify competitive social comparison and provide few opportunities for autonomy (Eccles, Midgley, Wigfield, Buchanan, Revman, Flanagan & MacIver, 1993; Guthrie & Wigfield, 2000; Unrau & Schlackman, 2006).

To address these causes of declining motivation, my intervention leverages adolescents' tendencies to engage in social comparison and evaluation, but it does so in a positive, non-competitive manner. It provides struggling adolescent readers with similar peer models who act as supportive friends, communicating high standards for strategy use and high intrinsic motivation and value for reading.

Effects of Motivation on Reading Comprehension

There is no dispute that good readers are active and motivated readers. Constructing meaning from a text is a cognitively demanding activity that requires attention, effort, and purposeful engagement (Gersten et al., 2001; Guthrie & Wigfield, 1999). Especially for struggling readers, it may also demand enormous task persistence.

Expository texts, the reading staple of students in the upper grades, are even more cognitively and, therefore, motivational challenging for a variety of reasons. Logical arguments in expository texts are typically more abstract than events in narratives (Trabasso, 1984). Additionally, the structure of expository texts are more varied and complicated than those in narrative texts (Hare, Rabinowitz & Schieble, 1989).

Researchers have proposed various models for the effects of reading motivation on reading comprehension. For instance, Wang & Guthrie (2004) posited that a two-factor (intrinsic and extrinsic motivation) model could have direct and independent effects on reading comprehension. They also specified that these factors might have indirect effects through amount of reading and enjoyment of reading. They defined their two factors as consisting of the afore-mentioned motivation constructs as well as others such as avoidance, grades, recognition, etc. On the other hand, Pintrich (2000) focused on strategy use. He suggested that reading motivation might exert its effects indirectly by influencing students' strategy use and persistence at using and/or adjusting their reading strategies.

Empirical Evidence. While few studies have examined the pathways by which motivation influences reading comprehension, a substantial body of research has documented the associations between the two.

National study of reading engagement and achievement. Campbell, Voelkl, and Donahue (1997) observed a pronounced impact of engagement on reading achievement in their analysis of National Assessment of Educational Progress (NAEP) 1996 student data. Their national sample of students included those at three age levels: 9, 13, and 17-year olds. The researchers found astounding effects of engagement, such that highly engaged 13-year old students were higher in their reading achievement than less engaged 17-year olds. Furthermore,

reading engagement seemed to counteract the effects of family income and education background, such that engaged readers from low-income families achieved higher reading levels than less engaged students from higher-income, more educated families (Guthrie & Wigfield, 2000).

International study on comprehension effects of intrinsic and extrinsic motivation. In a study of American and Taiwanese fourth graders, Wang & Guthrie (2004) examined the relations between children's reading motivation, amount of reading, and comprehension of narrative texts. To measure motivation, they used eight out of eleven scales from the original Motivation for Reading Questionnaire (MRQ), including curiosity, involvement, preference for challenge, recognition, grades, social, competition, and compliance. They did not measure reading efficacy, task value, or work avoidance motivations. To measure comprehension, they used the narrative sections of the International Association for the Evaluation of Educational Achievement (IEA) Reading Literacy Test.

Using correlation analyses, confirmatory factor analyses, and structural equation models, the authors reported a number of interesting findings. First, they confirmed a two factor model of reading motivation. However, the correlations between intrinsic and extrinsic motivation were quite high, $r=.75$ for U.S. students and $r=.81$ for Taiwanese students.

Additionally, they showed that intrinsic motivation had a positive direct association with text comprehension for both groups of students after controlling for past reading achievement (standardized path coefficients = $.64$, $p<.01$ for U.S. students and $.73$, $p<.01$ for Taiwanese students). Likewise, extrinsic motivation had a negative direct association with text comprehension when past reading achievement, intrinsic motivation, school reading amount, and enjoyment were controlled for (standardized path coefficients = $-.57$, $p<.01$ for U.S. students and

-.68, $p < .01$ for Taiwanese students). There were no indirect effects of either motivation construct through the proposed factors, reading enjoyment and school reading amount.

Intercorrelations between motivation constructs and reading comprehension suggested that enjoyment of reading, involvement in reading, and preference for challenge were all positively and significantly related to the students' comprehension of narrative texts.

Correlations for these constructs were $r = .20$, $p < .01$, $r = .21$, $p < .01$, and $r = .22$, $p < .01$ respectively.

These results indicated that intrinsic motivation was predictive of reading achievement and was equally salient in U.S. and Chinese children's reading experiences. Furthermore, they disconfirmed the authors' original hypothesis that differences in culture might lead to different models of influences in the two groups of students.

Moderating influences. Research suggests that the effects of motivation on reading comprehension may differ across subgroups of children, especially subgroups of low-performing ethnically diverse students.

Motivational patterns among low-performing readers. The relation between motivation and comprehension may be even more critical for struggling readers. Social and classroom motivational factors may further intensify and complicate personal challenges.

With regard to personal challenges, low-achieving readers in middle-school level are often low in a variety of reading processes tied to reading comprehension (e.g., vocabulary knowledge, fluency, strategy use) including motivation (Guthrie, Wigfield, Barbosa, Perencevich, Taboada, Davis, Scaffidi, & Tonks, 2004). When compared to normally-achieving peers, lower-performing children have lower academic self-concept, sense of control, self-efficacy, and expectations for success. Likewise, they have more negative self-evaluation tendencies and more self-deprecatory attributions (Olkinuoura & Salonen, 1991). Faced with

cues that a reading task might be difficult, these children respond with negative self-evaluations and self-focus. In contrast, their higher-achieving peers are likely to respond with task-focus and persistence.

Dealing with such negativity demands quite a bit of cognitive energy, which may detract from energy that is available for text processing. It also leads to a variety of avoidance behaviors that further depress children's reading achievement. For example, lower-achieving readers tend to select environments and activities that minimize their reading, thereby limiting their opportunities for improvement (Gersten et al., 2000; Morgan & Fuchs, 2007).

As if this were not enough, many lower-performing students must also deal with teacher practices that only further impede their academic success. Citing numerous research studies, Fuchs et al. (1997) catalog a number of maladaptive responses that teachers tend to have to their lowest-achieving students: Teachers provide less wait time for answers, criticize more often for failure, interact less frequently and in a less friendly manner, provide briefer and less detailed feedback, and provide fewer opportunities for practice.

In response to these multifold, multi-force challenges, lower-performing students can develop complicated constellations of beliefs and behaviors ("motivational orientations") to cope with their own feelings and their teachers' responses. Drawing from their in-depth research and interventions with such students, Olkinuora & Salonen (1991) characterized two of these motivational orientations typical of low-achieving children.

- *Ego-Defensive Orientation* – In this orientation, children who have encountered excessive academic failure have a weak sense of control in terms being able to manage the demands of a task and in terms of obtaining performance-related social satisfactions. They do not experience task challenges as positive starting points but

rather as uncomfortable obstacles that increase anxiety. As a result, they engage coping strategies that include different kinds of avoidance behaviors—passivity, withdrawal, active-aggressive (manipulative) social behaviors, and substitute behaviors. Their avoidance responses tend to temporarily alleviate motivational-emotional conflict or to postpone the intensification of tension. However, they also provoke certain typical responses from teachers: If the teacher “gives up” and does not persist with new approaches, the child’s coping strategy has “succeeded” and is reinforced. As a result, the low-performing student continues to manifest avoidance behaviors.

- *Social Dependence Orientation* – In this orientation, low-performing children attempt to gain a sense of control by responding to the social, rather than the cognitive, demands of a task. They are guided by the need for social affiliation and approval. Two coping strategies common to this orientation are babyish appeal behaviors (e.g., chatting or repeating facts under consideration) and more advanced social tactics for eliciting social support from the adult such as cheerfulness, uninhibited guessing (feedback-hunting), and giving fluent but inconsistent and/or incoherent answers. As expected, such behaviors do not lead to deep processing of texts or instructional materials. These socially dependent behaviors, though, do provoke typical responses from teachers: Students with this orientation are often over-helped and rewarded.

In both of these orientations, *non-task* motives and coping tendencies dominate the child’s learning experience. Olkinuora & Salonen (1991) also observed that even when children were task focused, subtle changes in task characteristics, social feedback or group dynamics could shift their efforts into ego-defensive or socially-dependent ones. Their research suggests

that it may be possible to convert these impulses into more adaptive ones by changing contextual factors. Additionally, their findings suggest that efforts to increase motivation, for example, by increasing challenge or autonomy, may have differential effects on low-performing students.

Ethnic differences in motivational patterns. Wang & Guthrie (2004) found no differences in the effects of intrinsic and extrinsic motivation on reading comprehension for American and Taiwanese children. However, others have posited that ethnic differences do exist. To test this more systematically, Unrau & Schlackman (2006) conducted a study with 2,000 economically-disadvantaged students in a California middle school. Of these students 75% were Latino (mostly from Central American countries) and 25% were Asian (mostly of Chinese descent). Notably, students in English-as-a-Second Language (ESL) classes were excluded from the study. They employed a research design very similar to that of Wang & Guthrie (2004) with the exception that they used the Gates-MacGinitie Reading Comprehension Test rather than the IEA test. As with the original study, these researchers *excluded* the efficacy subscale in their measures of motivation.

The authors *did* find differences in the patterns of motivation for these two groups of students. For Asian students, they confirmed the pattern observed by Wang & Guthrie (2004): Intrinsic motivation had a considerably positive and direct effect (standardized path coefficient = .55, $p < .05$), and extrinsic motivation had a strong negative effect (standardized path coefficient = $-.47$, $p < .05$) on reading achievement. For Latino students, however, neither intrinsic nor extrinsic motivation significantly influenced reading achievement.

Correlation analyses suggested further differences. For Latino students, *none* of the motivational subscales positively correlated with achievement. At low levels, curiosity ($r = -.11$, $p < .01$) and social ($r = -.16$, $p < .01$) negatively correlated with reading achievement. For Asian

students, involvement ($r=.23$, $p<.01$) and preference for challenge ($r=.16$, $p<.12$) positively correlated with reading achievement.

To explain these results, Unrau & Schlackman (2006) suggested a cultural hypothesis, drawing particularly upon the work of McKenna and colleagues (1995) and of Ogbu (1983, 1991). McKenna, Kear & Ellsworth (1995) propose that children's "internalization of cultural values and beliefs" contributes to "social norms" that influence their motivation. Culture is considered "a system of values, beliefs, and standards which guide people's thoughts, feelings, and behavior" (Au, 1993, p. 4). It is shared, learned, symbolic and adaptive (Bodley, 1994).

Ogbu (1983, 1991) and Ogbu & Simons (1998) classify minority populations in the United States as belonging to *voluntary* or *involuntary groups*. Voluntary groups are those that immigrated to the U.S. willingly, usually to improve their lives. This group includes many Asian ethnicities and Mexicans. Involuntary groups are those individuals (and their descendants) who have unwillingly joined American society, including African-Americans and Native Americans. Whereas voluntary minorities tend to have a self-deterministic vision of their lives in America—believing that hard work and education will enable them to achieve their dreams—involuntary minorities may be more pessimistic about American institutions. Unrau & Schlackman (2006) suggest that the Central American students in their research may have patterns of motivation similar to those in involuntary groups and may place their locus of country outside themselves. As such, their achievement would be less likely to be affected by intrinsic motivation. The role of culture in academic motivation and motivational influences on learning is still unclear and warrants further study.

Peer modeling and motivation. As discussed in an earlier section of this document about peer-assisted learning, providing students with opportunities to learn directly or indirectly

from other students can result in positive outcomes related to both motivation and learning. As previously indicated, peers can model enthusiasm, competence and possibilities for success, thereby inducing the same in their learning companions. They can promote autonomy and higher performance standards. They can provide support and encouragement, and they can serve as a source of co-regulation by coaching their companions on to greater self-regulation.

My Intervention. My research builds upon existing motivational theory as it relates to instructional practices. I focus on situational motivation and three of the motivational constructs that have been found to support reading achievement—self-efficacy for reading, intrinsic motivation, and learning-related emotions. I use items from the MRQ that measure intrinsic motivation. I am sensitive to the motivational issues of lower-achieving students and have attempted to address in the design of my program. Likewise, I am particularly interested in how findings about ethnic differences in children’s motivational patterns will play out in my research.

Additionally, my work elevates young people as learners, teachers, and potentially creators. Accentuating the possibilities for struggling readers to learn from symbolic models—peers who are similar but who are not present (and therefore not psychologically threatening in any way)—may address some of the moderating influences of ethnicity and achievement level on motivation and comprehension.

Finally, my intervention takes an *assets approach* to improving adolescents’ reading comprehension. It capitalizes on their interest in and fluency with computer technology (Lenhart, Madden, & Hitlin, 2005; Tsikalas, Lee & Newkirk, 2008). For example, the computer-based reading environment that I designed for this study is flexible enough that teachers and students may produce content for it. In fact, participants in my pilot research already proposed that they create their own videos to supplement texts.

Interventions to Boost Both Motivation and Reading Comprehension

While it is generally understood that good teachers must attend to motivational issues in their instruction, in recent years there has also been an effort to develop intervention programs that integrate motivational and cognitive support for reading comprehension. Two approaches are described below.

Concept-Oriented Reading Instruction

Guthrie, Wigfield and their colleagues at the University of Maryland at College Park have developed a broad-scale curricular program to foster elementary school children's reading comprehension, motivation, and engagement in reading (Guthrie et. al, 2004). Over the last ten years, they have also conducted a great deal of research on its effectiveness as well as on the relation between specific aspects of reading motivation and reading achievement. Their work focused on children in grades 3 through 5.

Concept-Oriented Reading Instruction (CORI) is a classroom intervention that promotes the use of multiple comprehension strategies—activating background knowledge, questioning, searching for information, summarizing, organizing graphically, and structuring stories—while simultaneously supporting children's motivation for reading. It employs five practices for motivational support: (a) using content goals and conceptual themes in reading instruction, (b) providing hands-on science activities, (c) affording students control and choice, (d) using interesting texts, and (e) promoting collaboration in reading instruction (Guthrie et. al, 2004; Guthrie, McRae, Coddington, Klauda, Wigfield, Barbosa, 2008). Additionally, its curricular focus is science inquiry. Within the program, students explore issues related to ecology, with one common theme being “Survival of Life on Land and Water.”

Typically, the CORI program is administered for 12 weeks in daily, 90-minute sessions. With regard to strategy instruction, each strategy is first taught individually for one week over the course of the first six weeks. During the second 6-week period, the strategies are integrated.

CORI requires a considerable investment in teacher professional development. Generally, teachers participate in 3-10 day summer workshops to learn the principles and techniques of this approach. Additionally, they may participate in monthly on-going workshops. The program also requires a school-wide commitment, as it essentially replaces other forms of literacy or science instruction.

Comparison of CORI with Strategy and Traditional Instruction (Grade 3). Using an equivalent groups pretest-posttest design, Guthrie et al. (2004) compared the effects of CORI with strategy instruction.

In a first study, participants were third graders enrolled in four schools. Eight classrooms in two schools used the CORI program. The other students received Strategy Instruction (SI) on the same strategies promoted in the CORI model. Reading motivation, strategy use and comprehension were measured as outcomes.

The researchers used an abbreviated version of the MRQ (Wigfield & Guthrie, 1997), including measures for self-efficacy, curiosity, involvement, and preference for challenge dimensions, to assess motivation. To assess strategy use – activating prior knowledge, questioning, searching for information, and organization—they used open-ended writing tasks.

To assess reading comprehension, the group used two, experimenter-developed tests – a “multiple text reading comprehension” test and a “passage comprehension” test. For the multiple text reading comprehension test, students read a 75-page packet that included an equal number of easy (grade 2 level) and difficult (grades 4-6 level) texts on nine ecological contexts.

In an open-ended response task, students were given 30 minutes to write what they knew after reading. Responses were coded with a 6-level rubric. For the passage comprehension test, students read one of three versions of a 4-page text (grade 3 level) about an animal (bats, sharks or polar bears). They, then, performed a 20-minute task on the computer in which they related the relatedness of word pairs drawn from the passage that they read. The Pathfinder computer program was used to analyze word-pair proximity ratings and to compute scores that represented the structural coherence of children's knowledge representations. Implementation quality was also assessed.

Data were analyzed using ANCOVA procedures in which the covariate was implementation quality. The level analysis was the classroom. While there were no pretest differences between the classes in each instructional condition, there were significant differences in favor of the CORI program on all four posttest measures:

- Multiple text comprehension: CORI (M=3.65), SI (M=2.87), effect size of ES=1.01.
- Passage comprehension: CORI (M=0.56), SI (M=0.31), effect size of ES=1.32.
- Motivational composite: CORI (M=14.50), SI (M=13.71), effect size of ES=0.98.
- Strategy use composite: CORI (M=7.72), SI (M=1.80), effect size of ES=1.23.

Additionally, there researchers found that motivation variables highly correlated with reading comprehension and with strategy use.

In a second study in this same report, Guthrie et al.(2004) added a Traditional Instruction (TI) comparison group, a standardized measure of reading comprehension (the Gates-MacGinitie Reading Comprehension Test-Level 3), and additional procedures for instructing struggling readers that included more fluency and simplified strategy instruction. Participants were again

third graders, and the implementation and research design were similar to that of the first study. Notable, students' motivation was assessed by teacher ratings in this study.

Again, this study showed significant differences between the three instructional programs, though these differences were not as pronounced as in Study 1. No analyses were conducted to examine the effects of instructional program on struggling readers

- Gates-MacGinitie: CORI classes (M=498.60) scored significantly higher than both SI and TI classes (M=468.57 and M=483.33, respectively)
- Passage comprehension: CORI classes (M=0.46) were significantly different from TI classes (M=0.35) but not different from SI classes (M=0.38)
- Multiple text comprehension: No significant differences among the groups.

Comparison of CORI with Traditional Instruction for Low- and High-Achieving Students (Grade 5). Using a similar research and implementation design, Guthrie et al.(2008) examined the effects of CORI for low- and high-achieving readers. They hypothesized that low- and high-achieving students would both show an advantage of CORI over TI on several outcomes.

Participants in the study were 156 fifth grade students: 94 students in six classes were instructed with the CORI program; 62 students from three classes received traditional instruction. Approximately 44% of the CORI (n=41) and 35% of the TI students (n=22) were characterized by their teachers as being low-achievers. Among low-achievers, 7% of CORI students 22% of TI students were designated as Special Education, 12% of CORI and 14% of TI students were English Language Learners (ELLs). None of the proportions was significantly different from each other.

In the study, multiple measures of comprehension were used. These included the comprehension section of the Gates-MacGinitie Reading Comprehension Test (students were given either a Level 4, 5, or 6 test based on their teachers' rating of their ability); an experimenter-developed inferencing test; an experimenter-developed Word Recognition Assessment (WRA); the Woodcock-Johnson III Reading Fluency Test; and an experimenter-developed Passage Oral Reading Assessment (PORA).

Motivation was measured somewhat differently in this study than in others conducted by the research group. Notably, self-efficacy, perceived difficulty, and avoidance were included in the motivational questionnaire. Additionally, intrinsic motivation was operationalized as enjoyment and avoidance (its reverse) rather than curiosity, involvement, and preference for challenge. Finally, fewer than usual items were used to assess each of these subcomponents.

The program was implemented as six weeks of daily, 90-minute instruction. For low-achieving students, more individualized instruction was provided and texts were provided at their level of reading. ANCOVAs were computed at the classroom level of analyses controlling for prior level of reading comprehension and quality of program implementation.

The results for this study showed main effects in favor of the CORI classes on the Gates-MacGinitie Reading Comprehension Test. CORI classes ($M = 505.00$) scored significantly higher than TI classes ($M = 486.63$) with an effect size of $ES = .59$, ($F = 4.86$ $df = 1,12$, $p < .048$). Similarly, CORI classes performed better on the Word Recognition Assessment: CORI ($M = 93.09$) was significantly higher than TI ($M = 76.68$) with an effect size of $ES = .87$, ($F = 7.52$, $df = 1,12$, $p < .02$). There were no significant treatment effects on students' inferencing or reading fluency. There were no significant effects of Achievement group (low- versus high-

achievers) on posttest scores, and the interaction between instructional treatment and Achievement group was also non-significant.

Most striking in this study, however, was the *absence* of motivational effects related to the CORI program. There were no significant differences between CORI and TI classes on either the motivational composite or the individual motivational constructs of self-efficacy, perceived difficulty, intrinsic motivation or avoidance. There were effects of Achievement group on both intrinsic motivation and avoidance, such that higher-achieving students reported greater intrinsic motivation and less avoidance. No significant interactions between instructional treatment and Achievement group were evidenced.

Findings from this investigation indicate that the CORI instruction can improve the reading comprehension of both low- and high-achieving students, but it may not be doing so through expected motivational channels. In explaining the study's surprising results related to motivation, Guthrie et al. (2008) noted the difference in the way that intrinsic motivation was measured in this study as well as the reduced number of items for all motivational constructs. They concluded that these changes may have led to less valid measures of reading motivation and reducing the investigation's sensitivity to intervention effects.

Integrating Strategy Instruction with Coping/Attribution Retraining

In an approach that is quite different from the CORI work, the Finnish research team of Vaurus, Kinnonen and their colleagues (Kinnunen & Vaurus, 1995; Vaurus, Lehtinen, Kinnunen & Salonen, 1991) have developed and investigated a highly-contextualized approach to improving the comprehension of struggling readers. In this case, the context is the motivational orientation of the child. Like CORI, their approach integrates motivational support with strategy instruction. However, it does so by teaching students to directly address their own micro-level

maladaptive motivational beliefs and strategies rather than by providing a generally motivating context for learning.

Vaurus et al. (1991) conceptualize the maladaptive motivational processes of low-performing students as “socio-emotional coping strategies.” They assert that, due to long and cumulative failure-prone histories, such children engage primarily in non-task coping in academic settings. Furthermore, they suggest that the academic experiences of low-achievers tend to be dominated by feelings of insecurity, fears of disapproval, and needs for social acceptance.

Their intervention involved training students to use five comprehension strategies – activating relevant prior knowledge, detecting difficult words and reasoning their meanings from text cues, identifying main ideas, summarizing, and self-monitoring of comprehension. The motivational component involved video-taped peer, coping models. The children on the videotapes verbalized negative motivational beliefs and behaviors, including low self-efficacy, high perceived task difficulty, avoidance tendencies and negative attitudes. Gradually, as the models persisted in reading and coping with task demands, their verbalizations changed and became more positive and self-supportive. After viewing videos of the peer models, participants in the intervention reflected upon and discussed their own beliefs, behaviors and performance in comparison. Based upon these discussions, the teacher also adopted deliberate interactional patterns to reduce ego defensiveness or social dependence in the child.

In a pretest-posttest experiment, Vaurus et al. (1991) compared the effects of this strategy-coping intervention (S+C: n=11) with strategy training alone (S: n=11), coping training alone (C: n=12) and two control groups comprised respectively of poor (CP; n=11) and good (CG; n=19) students. Participants in the experimental and CP conditions were 45 fourth graders

who were characterized by their teachers as having moderate-to-severe comprehension and learning difficulties. The training programs were carried out in 16 two-hour sessions, with groups of three students receiving instruction once a week.

To assess students “text-processing skills” (reading comprehension), the authors employed three experimenter-developed measures. These included an anomaly detection task in which eye movements were tracked, and a summarization task in which children were asked to write a summary of a 180-word history text after reading it. An essay task in which students wrote summaries of texts they had read four months earlier served as a delayed posttest/transfer task. Additionally, the researchers collected observational data (videotapes) about participants’ cognitive and coping behaviors.

On the summarization task, significant gains were made by children in both the S+C and the S conditions. Similarly, eye-tracking data showed that both of these groups of students showed signs of higher levels of text processing and comprehension monitoring after training. On the transfer test (delayed posttest), only participants in the S+C condition showed progression in higher-level text processing.

Examination of the videotape data suggested that training condition might have some impact on the success of scaffolding discussions around strategy use. Children in the S condition experienced increases in ego-defensive behavior as the training progressed and task demands increased. This pattern was not observed among children in the S+C condition. The authors noted that relaxed and task-oriented functioning within small groups typically did not emerge until after several sessions of working together.

My intervention. My work draws from lessons of the CORI program by providing students with opportunities to interact with interesting texts, to exercise some degree of choice

and autonomy, and to learn from other children. Likewise, it is informed by research around socio-emotional coping and attribution retraining. Most notably, I borrow Vaurus and Kinnunen's idea of using videotaped peer models to improve maladaptive motivational patterns.

At the same time, my approach offers a method for integrating cognitive and motivational support for reading comprehension that requires less of an investment on the part of teachers and schools. It may supplement, rather than replace, current classroom practices. Educators who participated in my pilot research, for example, expressed interest in using this approach in pull-out and after-school programs that often lack structure.

CHAPTER 3: METHODS

This experiment was designed and conducted to answer five research questions:

1. What are the effects of peer modeling/influence on the reading motivation of struggling adolescent readers?
2. What is the effect of peer modeling/influence on these students' self-monitoring as indicated by the accuracy of their comprehension judgments?
3. What are the effects of peer modeling/influence on the quality of questions that such students ask about expository texts?
4. What are the effects of peer modeling/influence on these students' comprehension of expository texts?
5. If effects are present, what processes (motivational, self-regulatory, strategic or other) best explain them?

Chapter 3 describes the experimental design, participants, materials, measures, and procedures, and data analyses that were used to answer these questions.

Experimental Design

The data analyzed and presented in this dissertation were part of a larger study that included additional participants (those reading far below and slightly above grade level) and additional texts at varying levels of difficulty.

This study employed a 2 (gender) x 2 (experimental condition) x 2 (difficulty level of texts) factorial design. Texts with different levels of difficulty were used so that each participant read a passage that was moderately challenging, i.e., somewhat above his or her baseline level of comprehension. A balanced design, with equal numbers of participants per cell, was intended.

However, due to various circumstances in implementation, this balance was not quite achieved.

Table 1 displays the experimental design as implemented.

Table 1: Research Design

Gender	Text Difficulty Level	Experimental Condition	
		Strategy Control (n=20)	Peer Modeling/Influence (n=28)
Female	High 5 th grade level	n=13	n=20
	High 6 th grade level		
Male	High 5 th grade level	n=7	n=8
	High 6 th grade level		

Based on their baseline-level of reading comprehension, participants were first placed in matched pairs or triplets. Each group was then assigned an experimental text of appropriate difficulty level. Formation of these matched groups was done to ensure that readers would be assigned the correct level of text and to safeguard against a situation in which the difference between the reading level of the participant and his/her assigned text was greater than two grade levels.

Within the pair or triplet, participants were then randomly assigned to either the Control Condition (Computer-based strategy instruction but *no* peer modeling) or the Peer Modeling/Influence Condition (Computer-based strategy instruction with embedded video-clips of *peer models* asking authentic thinking questions about the text).

All participants completed a brief computer-based tutorial on question asking as a way to improve reading comprehension. Following this preparation activity, they read a moderately challenging 400-word expository text using a special computer-based reading environment. Within this reading environment, students in the *Peer Modeling/Influence* condition were presented with short, embedded videos that featured three other adolescents asking questions

about the text at two times—prior to the reading the text themselves and then again after reading it. They were then prompted to ask their own questions about the text. Students in the *Control Condition* were simply prompted to ask their own questions about their text after reading it. They received no peer support. Table 2 provides details about each of the experimental conditions.

Table 2: Specifications of Experimental Conditions

Intervention Components	(1) Strategy Control (n=20)	(2) Peer Modeling (n=28)
Interactive tutorial on question-generation as a comprehension strategy.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Computer-based reading environment with expository texts, interactive vocabulary support, and question-generation prompts.	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Generic question-generation prompts presented as text and spoken aloud.	<input checked="" type="checkbox"/>	
Question prompts preceded by video clips of peer models using the question-generation strategy to ask authentic questions. These questions are also displayed in text.		<input checked="" type="checkbox"/>

Participants

Participants were 48 sixth-grade students attending public middle schools in New York City. All were fluent English speakers and readers, and all received parental permission to participate in the study. Students who participated in the study read within the range of 550L - 850L, as measured by the Scholastic Reading Inventory (SRI). This Lexile range corresponds roughly to a high 3rd grade to low 6th grade reading level (MetaMetrics, 2008). As such, students in the experiment read at grade-level or one to two levels below grade-level.

In the middle schools that participants attended, more than 80% of students were eligible for free lunches, and more than 95% for free or reduced-priced lunches. The majority of students at these schools (60-75%) were Hispanic/Latino and 16-24% were Black/African-American, New York State School Report Cards (2010).

Participant Recruitment

Through consultation with school administrators and other program liaisons, I identified teachers at three different research sites to serve as Site-based Research Coordinators (SBRCs). These individuals assisted with my research by identifying classes of students for participation, distributing information to students and parents, identifying times when and rooms where it was most convenient to work with the students, and coordinating research sessions.

Each SBRC recommended several classes of students (25-85 students) to participate in the study. Through school mailings and phone messages, the project was explained to students and their parents or guardians. Parental Permission Forms were also distributed at this time. (See Appendix B for sample notices that were sent to parents and broadcasted through the automated phone system.) Students who returned signed Parental Permission Forms were entered into a raffle to win a \$25 gift card, and seven gift cards were awarded.

Inclusion in the Sample

All students with signed parental consent and who themselves agreed to participate in the project were considered as potential participants. These students completed the Scholastic Reading Inventory (SRI) and a survey of reading attitudes and behaviors to further assess their eligibility. Sixth graders who scored within the range of 500L-900L on the SRI were invited to participate in the larger project of which this study was a part; 78 students met the criteria.

However, for the research featured in this dissertation, participants were limited to those 48 students scoring between 550L and 850L on the SRI.

Materials

This experiment employed four sets of original materials. These were: (1) an interactive tutorial on a question-generation strategy; (2) two expository, science texts; (3) a computer-based reading environment which displayed the texts and provided vocabulary support, prompts for question-generation and peer modeling video clips; and (4) question prompts with or without peer modeling segments. Each is described below.

Interactive Tutorial on Question Generation as a Comprehension Strategy

A fully-narrated, interactive strategy instruction tutorial was created for this research. The tutorial, entitled “Escape from IDunno: How to Learn Better by Asking Real Questions,” is an auto-play Power Point file and is divided into two parts – an instructive component and a practice component. The questioning strategy selected for use in this study involved “question-type” procedural prompts (Rosenshine, Meister, & Chapman, 1996). In contrast to other types, such as signal word prompts (e.g., why, what, how), main idea prompts or generic question stems, these question-type prompts encouraged learners to ask authentic questions within certain categories.

The three categories or types of questions in this study were drawn from King’s (1994, 2002) linking and thinking questions and from Rafael & Pearson’s (1985) Question-Answer-Relations (QARS). They were: Think & Search, I Wonder, and I’m Confused questions. Each question-type was associated with a playful cartoon character (see Figure 2). These characters

provide a visual mnemonic for the question-types; they also reinforce the idea that asking questions (and finding their answers) can be fun.

- *Think & Search questions* are those for which answers may be found within the text. These questions are concerned with a *text-based level of comprehension* and involve activities such as using context cues to determine the meaning of words and locating referents for ambiguous pronouns. Think & Search questions require the learner to locate and recall information, clarify concepts and make connections across the text and make *cohesive inferences*.
- *I Wonder... questions* encourage the learner to activate prior knowledge, connect their own experiences to the topic of the text, interpret and innovate, and make *cohesive, elaborative and knowledge-based inferences*. They are useful in helping the learner construct a *situation model* of the text and may support motivation.
- *I'm Confused... questions* are those in which learners examine the text material in light of what they already know. Readers must identify discrepancies or conflicts in what they believe or know to be true and what they have read. These questions require them to activate prior knowledge, connect their own experiences to the topic of the text, identify information they do not know, compare information from their experiences with information from the text, take a critical stance on the text and make *cohesive, elaborative, knowledge-based, and evaluative inferences*. They are useful in helping learners build *text-based* and *situation model* representations.

In the instructive part of the tutorial, participants learned how asking questions could help them better understand a text. They were taught the three different question-types and given examples of each type. During the practice portion of the tutorial, they read a one-paragraph text

(85 words) on the topic of plant communication. After reading this paragraph, they viewed four example questions generated about the text. Participants then played a quiz-type game in which they categorized the example questions as Think & Search, I Wonder or I'm Confused questions. They were given feedback about their correct or incorrect choices and were allowed to continue until they obtained the correct answer for each example question.

Figure 2: Visual Mnemonics for the Question-Types



Expository Texts

Two medium-length, expository science texts were used in this experiment. Both were problem-solution texts: One described a problem in which vampire bats in South America were inadvertently killing cows and horses by infecting them with rabies. Scientists solved this problem by creating a shot for the farm animals that thickened their blood; when the bats drank this thickened blood, they choked and died. The second text described problems in the construction of the John Hancock Tower. When the building was designed, architects did not take into account the strong winds of Boston. As a result, hundreds of windows broke during storms, rendering the tower non-functional and dangerous. To solve the problem, the team had to find and install a new kind of glass that would not break during strong winds. (See Appendix B for full copies of these texts.)

These experimental texts were adapted from versions presented in the *Kim Marshall Series* (Marshall, 2001). Pilot-testing with middle-school students in 2009 confirmed that they were of relatively high interest to both girls and boys. Table 3 describes characteristics of each text.

Table 3: Characteristics of Experimental Texts

Readability Feature	Text	
	<i>Vampire Bats</i>	<i>Tower</i>
Lexile Level	940L	910L
Flesch-Kincaid Grade Level	5.9	6.9
Causal Cohesion (ratio of causal particles to causal verbs)	0.846	0.632
Mean Sentence Length	14.75	15.96
Word Count	413	399
Number of Sentences	28	24
Mean Log Word Frequency	3.58	3.80

The *John Hancock Tower* text was considered to be the more difficult text for sixth-grade readers because its content was less familiar to students, its Flesch-Kincaid score higher, and its causal cohesion lower.

Computer-Based Reading Environment

The computer-based reading environment used in this study was developed both as a content management system and an authoring tool. As a content management system, it “delivered” texts along with other specified multimedia files, such as instructions (audio and text), vocabulary support (audio, text, and images), question prompts, and peer modeling video clips. As an authoring tool, it was built so that teachers and/or researchers might add their own texts and supporting files. Consequently, its content is adaptable and *not* limited to the original texts included in this study.

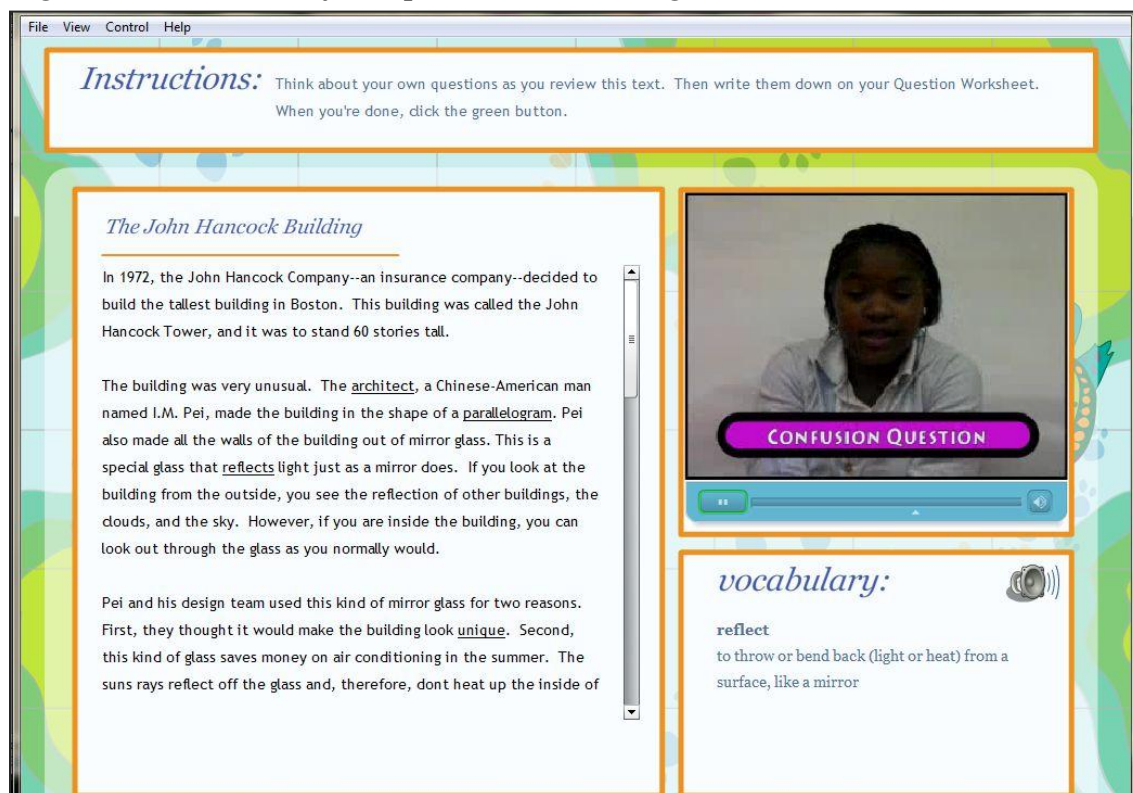
Designed in Adobe Flash, the reading environment displays content in a deliberate sequence that is described at length in the Procedures section. Experimental texts are presented along with clickable vocabulary links. When participants click on these links, definitions (with or without illustrations) appear in a separate side panel. To hear the definition read aloud, students may click on a “speaker” button within this side panel. After each section of text or video, participants click a “next” button. To prevent learners from simply clicking through the screens without reading them, there is a time delay before the “next” button is displayed.

In this study, the Control group received generic text and spoken prompts. These prompts instructed them to read the text and, later, to ask their own questions about it. The Peer Modeling/Influence group received these same prompts, but they were preceded by video clips of peer models asking their own questions along with the written text of those questions.

The reading environment was designed such that participants in the Peer Modeling condition could *not* advance until the entire movie (of peer models) had played. While they could pause and replay these movies, they were not informed that they had this capability. Figure 3 provides a screen shot of the environment, featuring the target text, vocabulary support, and video peer modeling.

Peer modeling videos. Each experimental text was associated with a peer modeling video. These videos featured three, diverse, middle-school students asking their own, authentic questions about the text. In the videos, after the child asked his or her question, that question was reiterated or summarized textually. In this way, learners could not only see and hear the peer models’ questions, but they could also read the gist of each question in case they had any trouble understanding the peer models’ speech. Table 4 summarizes the peer modeling videos.

Figure 3: Screen Shot of Computer-Based Reading Environment



Five questions were asked in each video. As previously discussed, these were real questions from the peer models. The questions for each text are listed below.

Vampire Bats Text

1. Do bats only live in South America? In movies, they say they live in caves around the world.
2. How did the bats drink the humans' blood without the people knowing?
3. The text says that vampire bats have radar, but I thought you needed metal for radar. How do they have metal in their bodies?
4. How much blood do vampire bats drink? Is it enough to kill a cow or horse?
5. Did all the bats bite the same dog to get rabies and pass it to the other animals? How could they all bite the same dog?

John Hancock Tower Text

1. Is the John Hancock Tower taller than the Empire State Building?
2. Why did Pei decide to make the building in the shape of a parallelogram? (Normally I see buildings just standing up straight.)
3. Who is Pei and did he ever become famous for his architecture?
4. Usually when we have strong winds here, the glass doesn't break. So, why is this glass breaking?
5. Why did it cost 7 million dollars to replace the glass?

Table 4: Characteristics of Peer Modeling Videos

Video Characteristics	Text	
	<i>Vampire Bats</i>	<i>John Hancock Tower</i>
Number of Peer Models	3 sixth graders	3 sixth graders
Demographics of Models	2 boys, 1 girl Latino and Caucasian	2 girls, 1 boy African-American and West Indian
Number of Questions	5 questions	5 questions
Question Categories as Identified by Models	3 "I'm Confused" questions 1 "I Wonder" question 1 "Think & Search" question	1 "I'm Confused" question 3 "I Wonder" questions 1 "Think & Search" question
Question Types as Classified by Graesser & Person (1994)	1 Feature Specification [shallow] 1 Quantification [intermediate] 3 Enablement/Process [deep]	1 Feature Specification [shallow] 1 Comparison [intermediate] 1 Goal Orientation [deep] 2 Causal Antecedent [deep]

Selection of models and questions included peer modeling videos. Peer modeling video segments were produced in Materials and Methods research that was conducted in advance of this experiment. In this earlier research, I worked with 25 middle-school students who, collectively, generated dozen of novel questions about each text. I used several criteria to select the final models and questions that were included in the experimental videos: (1) Models were to include both boys and girls of a variety of ethnic backgrounds; (2) questions were to represent all

three categories – I’m Confused, I Wonder, and Think & Search – with the preponderance being confusion or curiosity questions; and (3) questions were *not* all to be deep-level questions.

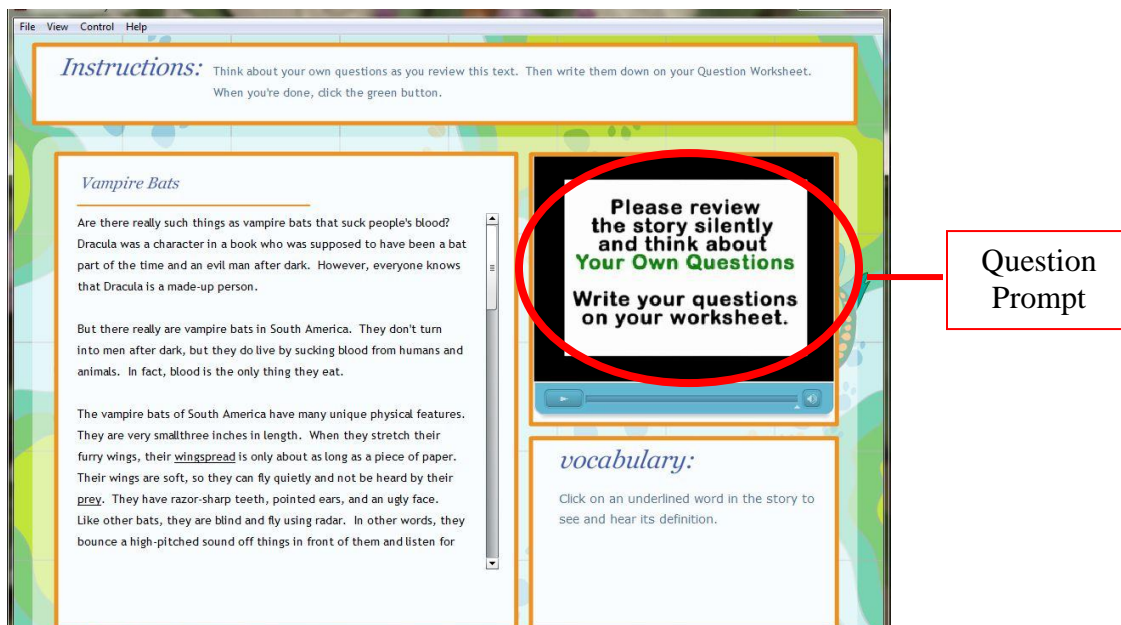
This latter criterion may seem somewhat surprising, as deep-level questions are believed to provide the best support for comprehension. The reason for including shallower-level questions derived from pilot research with low-performing readers. These students read the experimental texts after watching the peer modeling videos and then were interviewed about whether and how the peer models improved their text interest or comprehension.

From the pilot research, it was clear that a subset of lower-achieving readers was put at ease and supported in their comprehension by hearing models ask shallow-level questions that they themselves also had. One student noted: “That kid asked the same question I had, but I thought my question was too stupid to ask.” To encourage all participants to ask the questions they really had and to reveal misunderstandings (if they had them), some lower-level questions were included in the peer modeling videos.

Question prompts. Participants in both conditions received question prompts *after* they had read the text once in full. These prompts were presented as narrated text in the right corner panel of the reading environment, adjacent to the target text.

Question prompt for the Control condition. The question asking prompt for students in the Control condition appeared in text, was spoken aloud, and remained on the screen for at least five seconds. It instructed them to think about their own questions and to write these down on their Question Worksheet (see Figure 4).

Figure 4: Question Prompt for Control Condition



Question prompt for the Peer Modeling Condition. Students in the Peer Modeling condition also received a question asking prompt. However, this prompt was placed in a social context. Peer influence was simulated in two ways: First, participants were told that other students had asked questions that might help participants better understand the text. This message was designed to provoke feelings of social support. Then, participants were provided with video clips of peer models asking their questions. In the video clips, peer models gesticulated, expressed emotion and communicated both verbally and non-verbally that they had real questions and were interested in the content of the text. Not only did they demonstrate the process of asking questions, but also they modeled the motivation for doing so. The peer models' questions were labeled by question category and displayed as text on screen for about four seconds.

In cases where peer models asked their questions in a rather long-winded manner, the text version of their question was a summary. It represented only the key aspects or gist of the

question was presented. As in the Control Condition, participants were instructed to think about their own questions and record these on their Question Worksheet (see Figure 5).

Figure 5: Question Prompt for Peer Modeling Condition

The figure illustrates a software interface for a peer modeling condition. It features a central text area with the following content:

Instructions: Think about your own questions as you review this text. Then write them down on your Question Worksheet. When you're done, click the green button.

The John Hancock Building

In 1972, the John Hancock Company--an insurance company--decided to build the tallest building in Boston. This building was called the John Hancock Tower, and it was to stand 60 stories tall.

The building was very unusual. The architect, a Chinese-American man named I.M. Pei, made the building in the shape of a parallelogram. Pei also made all the walls of the building out of mirror glass. This is a special glass that reflects light just as a mirror does. If you look at the building from the outside, you see the reflection of other buildings, the clouds, and the sky. However, if you are inside the building, you can look out through the glass as you normally would.

Pei and his design team used this kind of mirror glass for two reasons. First, they thought it would make the building look unique. Second, this kind of glass saves money on air conditioning in the summer. The sun's rays reflect off the glass and, therefore, don't heat up the inside of

The interface includes four numbered callouts:

- 1**: A video frame showing text: "Once again, here are **Examples of Questions** other kids have asked about this story. They thought their questions would help you too. Watch again and then ask your own questions." This is linked to the callout "Simulated social support".
- 2**: A video frame showing a young girl speaking. A purple bar at the bottom reads "CONFUSION QUESTION". This is linked to the callout "Video-taped Peer Models asking Authentic Questions".
- 3**: A video frame showing text: "**'I'm Confused' Question:** Usually, when we have strong winds here, the glass in the windows doesn't break. So, why is this glass breaking?" This is linked to the callout "Peer Models' Questions Reiterated in Text".
- 4**: A video frame showing text: "Please review the story silently and think about **Your Own Questions**. Write your questions on your worksheet." This is linked to the callout "Question Prompt".

Measures

Screening and Baseline Measures

Screening and baseline measures consisted of a test of reading comprehension and a survey of reading motivation.

Scholastic Reading Inventory (SRI). The SRI is a computer-based, adaptive test of reading comprehension. Test items use an “embedded completion,” multiple-choice format similar to that found in fill-in-the-blank or cloze questions. Readers are first presented with text passages of 30 to 150 words and then with statements in which a word or phrase is missing. The statement portion of items may assess a variety of skills, including making inferences and comparisons, drawing conclusions, and demonstrating use of vocabulary knowledge. Four semantically- and syntactically-correct response options are provided, with one option being unambiguously the best response.

The SRI provides a single comprehension score; no subscale or component skill scores are provided. Text passages used in this assessment are drawn from “real-world” reading materials (fiction and non-fiction, literature and journalism) that students might encounter both in and out of school. Additionally, it uses the Lexile Framework for assessing comprehension levels. This same system may be used to calculate the difficulty level of texts. As such, the SRI is an effective way to match students with appropriately-leveled texts (MetaMetrics, 2008; Morsy, Kieffer, Snow, 2010; SRI, 2007).

Pre-Survey of Reading Motivation measures. A survey of reading motivation was administered to students after they had completed the SRI and before they were invited to participate in this experiment. This pre-survey consisted of 18 items that measured young people’s reading self-efficacy, their intrinsic motivation as indicated by curiosity and preference

for challenge, and their use of comprehension strategies. (See Appendix A for a copy of this instrument.)

Self-Efficacy for Reading. Four items were constructed to measure Self-Efficacy for Reading. The scale borrowed general items from Henk & Melnick's (1995) Reader Self-Perception Scale (RSPS) and Wigfield & Guthrie's (1997) MRQ. However, neither of these instruments, in itself, was quite appropriate for the current investigation: The RSPS items were very similar to items in the Intrinsic Motivation scale of the MRQ, and most were *not* projective in nature. The MRQ Efficacy scale included only three items, two of which were general and one assessing socially comparative judgments. Neither instrument measured reading self-efficacy for expository texts.

For the self-efficacy items in this study, participants responded using a 5-point Agreement scale, with options ranging from Strongly Agree to Strongly Disagree. Items were:

- I think I am a good reader. (General item-RSPS/MRQ)
- I know that I will do well in reading next year. (General item-MRQ)
- When I think about texts I have to read for science, I am sure that I will be able to understand them.
- I know what to do to make sure that I understand what I read for science.

An analysis of Cronbach's alpha for this index indicated that the fourth item reduced overall reliability. Therefore, the *Pre Self-Efficacy for Reading index score* was computed from the mean of the first three item scores, with higher scores representing higher self-efficacy for reading ($\alpha=.623$).

Intrinsic motivation. Intrinsic motivation as indicated by three subscales—Curiosity, Involvement, Preference for Challenge—has been found to predict students' reading

achievement and to be amendable through instruction (Wang & Guthrie, 2004; Guthrie; Guthrie et al., 2007). However, there is some evidence that these patterns do not hold for all students, particularly for minority students (Unrau & Schlackman, 2006). Participants and peer models in my study were ethnically diverse.

Items from the revised MRQ (Wang & Guthrie, 2004; Wigfield & Guthrie, 1997) were used to assess Curiosity and Preference for Challenge. Participants responded using a 4-point Likert scale with choices from Very Different from Me to A lot Like Me.

Curiosity

1. I have favorite subjects that I like to read about.
2. I read about my hobbies to learn more about them.
3. If the teacher discusses something interesting I might read more about it.
4. I read to learn new information about topics that interest me.
5. I like to read about new things.

Preference for Challenge in Reading

1. I like it when the questions in books make me think.
2. I usually learn difficult things by reading.
3. I like hard, challenging books.
4. If a book is interesting I don't care how hard it is to read.

In this experiment, an Index of *Reading for Curiosity* was computed as the mean of the first four curiosity items. Cronbach's alpha for this Index was 0.747. Similarly, an Index of *Preference for Challenge in Reading* was computed as the mean of the four Preference for Challenge items. Cronbach's alpha for this Challenge Index was 0.502. The Involvement

subscale was omitted because its items related only to narrative texts, and this study concerns adolescents' experience and comprehension of *expository* texts.

Some validity data were also available for the full (7-item) versions of these two scales. In a study of 100 fourth and fifth grade students, Wigfield & Guthrie (1997) found highly significant correlations between both curiosity and preference for challenge and children's amount and breadth of reading. In their study, reading amount represented the number of minutes per day that children read outside of school; the data were recorded by children's parents in reading logs provided by the school's media specialist. Breadth of reading was measured by a composite scale consisting of five self-report items in which children indicated the kind of books they read. For curiosity, correlation coefficients ranged from $r=0.24$ to 0.29 , $p<.01$ for amount of reading and from $r=0.22$ to 0.50 , $p<.01$ for breadth of reading. For challenge, correlation coefficients peaked at $r=0.22$, $p<.05$ for amount of reading and at $r=0.33$, $p<.01$ for breadth of reading.

Strategy use. Four items on the pre-survey were adapted from the *Classroom Modified Strategy Use Scale* (Pereira-Laird & Deane, 1997; Reutzel & Cooter, 2007). These items probed four reading strategies: Activating prior knowledge, re-reading, self-monitoring of comprehension, and questioning. Participants responded to each item using a 5-point frequency scale, with options including: Almost always, most of the time, sometimes, not much, almost never. The questions were:

- When I am reading about something, I try to relate it to my own experiences.
- When I do not understand something I am reading, I read it again and try to figure it out.

- When I read, I stop once in a while to go over in my head what I have been reading to see if it is making sense.
- I ask myself questions about what I am reading to help me understand it better.

Individual strategy use scores were used to characterize the sample and were tested as possible covariates and/or predictor variable in multivariate analyses.

Outcome Measures

Task Perceptions and Motivation. A survey was administered *after* the reading session with participants. This 10-item survey measured reading text interest, preference for challenge in future texts, perceived difficulty and judgment of learning. Additionally, participants in the Peer Modeling/Influence condition received an additional six items in which they rated the impact of the models' questions on their interest and reading comprehension. (See Appendix A.)

Text interest. In the post-survey, Text Interest was measured by five items: One item asked students directly about their interest in the text, and they responded using a 4-point Likert scale with values ranging from Not at all Interested to Very Interested. Two items related to Curiosity and were taken from the MRQ (Wigfield & Guthrie, 1997). Two were derived from Pekrun, Goetz, & Perry's (2005) Achievement Emotions Questionnaire and assessed participants' Enjoyment of the task. Participants responded to these latter four items using a 5-point Likert scale with values ranging from Strongly Agree to Strongly Disagree.

- I like to read to learn new things. (Curiosity)
- I would like to learn more about this topic. (Curiosity)
- I enjoyed reading this text. (Enjoyment)

- I read this text more carefully because I enjoyed learning about the topic.

(Enjoyment)

While I had planned to analyze Enjoyment, Curiosity and Text Interest as separate constructs, these measures were highly correlated and loaded on a single factor. As such, a *Text Interest Index Score* was computed as the mean of these five items, $\alpha = 0.725$.

Negative learning-related emotions. Both positive and negative learning-related emotions have been found to contribute to academic achievement (Linnenbrink & Pintrich, 2002; Schiefele, 1999). Pekrun et al.'s framework posits that emotions related to academic achievement can be distinguished by two qualities, their valence (positive/negative) and their activation state (activating/deactivating). Positive, activating emotions such as joy have been found to be positively associated with several components of learning, including self-reports of academic effort, intrinsic and total interest, use of elaboration strategies, and self-regulation. Likewise, negative, deactivating emotions such as boredom have been found to be negatively correlated with these aspects of learning (Pekrun, Goetz, Titz, & Perry, 2002).

The negative learning-related emotion of boredom was assessed in my post-survey instrument. Using a 5-point Agreement scale, participants rated their response to the following questions:

- This text bored me to death. (Boredom)
- My mind wandered while I was reading this text. (Boredom)

Because many of the students in my experiment were unfamiliar with the word “wandered,” the second item in the Boredom measure was dropped.

Preference for challenge in future texts. Participants' preference for challenge was measured by a single item that asked: For the next reading activity, would you like a text that is –

a lot easier, a little easier, about the same, a little harder, a lot harder? Students selected one response to this question.

Perceptions of peer models. Participants assigned to the Peer Modeling/Influence condition answered an additional six questions about their experience of the models.

Perceived similarity of peer models. Participants rated how similar the peer models were to themselves and their peers. Using a 10-point scale ranging from 0 to 100%, they indicated the extent to which:

- The kids I saw in this activity are like kids I know.
- The kids I saw in this activity are like kids me.

Impact of peer models. Participants also rated the impact of the models' questions on their interest and reading comprehension. They used a 4-point Likert scale to answer the following questions:

- The questions asked by the kids I saw in this activity made me more interested in the story.
- The questions asked by the kids I saw in this activity helped me to understand the story better.
- The kids I saw/heard in this activity did NOT help me very much.

Finally, participants indicated whether they tried to answer any of the questions asked by the models. The 4-point response scale for this question included the following values: No; Yes – But not many of the questions; Yes – Some of the questions; Yes – Most of the questions.

Comprehension Calibration. In this document, the term *Comprehension Calibration* is used interchangeably with the term *Accuracy of Judgment of Comprehension*. On the survey, all participants indicated their certainty of having understood the main ideas of the text they read.

On a scale ranging from 10% to 100%, they responded to the question: *How sure are you that you understand the main idea of this text?* This was considered a Judgment of Learning (JoL) score. Participants' comprehension calibration was computed by subtracting their percent overall comprehension score from this JoL score.

Question Asking. During the computer-based reading activity, participants were instructed to record their own questions on a Question Worksheet (see Appendix A). Additionally, they were to classify these as belonging to one of the three question categories taught during the strategy training (I'm Confused, I Wonder, or Think and Search), and to indicate whether they had thought about the answer to their questions. An explanation of the procedures used to score students' questions is provided in the Data Analysis section of this chapter.

Text Comprehension. Reading comprehension is a complex phenomenon and difficult to measure with any single reading test (Keenan, Betjemann, & Olson, 2008). In this study, multiple measures were employed to assess participants' text comprehension.

Structured oral interview. A structured oral interview was administered to each participant following their reading activities in the experiment, and it was audio-recorded (See Appendix A for copies of the interview questions for each text.) The interview consisted of an *Oral Retelling* portion in which six questions were asked about specific aspects of the texts and an *Oral Main Idea Summary*.

Oral retellings are post-reading recalls during which children communicate what they remember from reading a particular text. Retellings are one of the most effective ways to discern whether a child has understood what she or he has read. They provide a view of the quantity, quality and organization of information the child has constructed during reading. Additionally,

oral retellings provide information that is not limited by students' writing abilities. Finally, retellings may not bias students to process text in certain ways, whereas comprehension questions may do this (Lipson & Wixson, 2009; Moss, 2004).

The Oral Retelling portion of the interview was *not* a free recall. Rather, it consisted of prompted questions, and participants were probed to “tell more” or further explicate on their responses if these responses were unclear. An analysis of interview transcripts demonstrated that there were no differences between Control and Peer Modeling groups in the number of probes administered per student. Several measures were derived from the Oral Retelling:

- *Number of Idea Units Recalled* provided a count of the idea units in the text that participants articulated during the structured retelling portion of the interview. The measure represented the extent to which students had formed a text-based representation in their memories. Idea units were individually listed on the interview protocol, and during the interview, they were checked off if mentioned by the participant.
- *Number of Critical Idea Units Recalled* provided a count of the key ideas in each text that the student stated during the interview. It was converted to a percent score to standardize across the two texts and provided a measure of how well participants had grasped the main ideas of the text they read. Three judges reached agreement on the critical ideas for each text. For the Vampire Bats text, 14 critical idea units were identified; for the John Hancock Tower text, eight critical idea units were identified.
- *Understanding of Problem Score* was assigned by coders based on a review of the transcript of the entire oral interview (see Data Analysis section). It represented how

accurately and completely participants had understood the problem component of the passage they read.

- *Understanding of Solution Score* was assigned in the same way as the problem score (see Data Analysis section) and provided information on accurately and completely participants had understood the solution component of the text.
- *Detail Score* was assigned by judges based on the number of supporting details participants described in their interviews (see Data Analysis section).
- *Percent Overall Comprehension Score* was computed by summing the problem, solution, and detail scores and dividing by the total points possible.

Oral main idea summary. After students had answered all the Oral Retelling questions, they were prompted to state the main idea of the text. Their prompt was:

Imagine that your class was discussing this text and that your friend came late and didn't have time to read it. Your teacher asked you to quickly explain the text to your friend. What would you tell him/her?

Only one probe was administered to participants for this summary. Students were simply asked, “Anything else?” These main idea summaries were coded by judges for Problem, Solution, Detail, Topic, and overall scores that were parallel to those described above.

A final score for each of these components was selected based on the higher of the two scores – the Oral Retelling component scores or the Oral Main Idea Summary component scores.

Sentence Verification Task. Participants also completed a short written assessment consisting of 15 sentence verification items. However, due to problems with the internal reliability of this assessment, comprehension data from this task were *not* ultimately used in analyses (see Results chapter).

The Sentence Verification Technique (SVT) is thought to be a means of assessing *passage-specific reading comprehension*. It measures how well readers apprehend the linguistic message contained in a text and the extent to which they have established an accurate, “meaning-preserving” representation of this text in their memories. The method has been shown to be a valid and reliable measure of reading comprehension: It distinguishes between readers at varying levels of skill, differs based on the difficulty level of text passages, improves with instruction, and is correlated with other measures of reading comprehension. Furthermore, because of its method—readers identify which sentences among four types (original, paraphrase, meaning change, and distractor sentences) are *consistent with the message* of the text—it is less susceptible to prior knowledge influences than are other measures, such as multiple choice tests (Royer, 2004; Royer & Sinatra, 1994; Royer, Tirre, Sinatra, & Greene, 1989).

Construction of SVT Test Items. My study employed a variant of the SVT called the Meaning Identification Technique. This method, reported by Marchant, Royer & Greene (1988), uses only two types of sentences—paraphrases and meaning change paraphrases—and has somewhat better reliability and validity than standard SVT tests. Paraphrases were constructed by changing as many words as possible in an original sentence without changing its meaning. Meaning change paraphrases, in contrast, were constructed by changing one or two words in the original sentence that serve to completely change the meaning of that sentence (Royer, 2001).

Following the recommended procedures (Royer, 2001; Royer, 2004), approximately 50% of sentences (15 sentences) within each passage were selected for inclusion in SVT tests. Low-meaning sentences were excluded, such as those used to “hook” the reader at the beginning of the passage.

For each of the selected sentences, a paraphrase and a meaning change paraphrase was created. Fifteen of these alternate sentences (eight of one type, seven of the other) were then included on the test. SVT tests were pilot-tested with a very small sample of middle-school students in January 2010. No ceiling effects appeared to be present. (See Appendix A for a sample SVT test.)

Administration. For this assessment, participants read the instructions and were asked to raise their hand if they did not understand what they were expected to do. Students were presented with the 15 paraphrase and meaning change sentences. For each one, they marked whether the sentence was consistent with the meaning of the text (Yes-same meaning) or whether it differed in meaning from the text (No-different meaning).

Scoring. The proportion of correct responses was calculated for each category of sentence type – paraphrase and meaning change sentences. As mentioned above, these scores were *not* ultimately used in data analyses because of reliability and validity problems.

Procedures

Participant Selection and Assignment

Participants were sixth graders who read at or slightly below their current grade level as determined by the SRI.

Informed consent. Parental Consent and Student Assent were obtained for all potential participants. (See Appendix C for Consent and Assent Forms.) The students then completed the SRI and Pre-Survey of Reading Motivation as previously described. Just over half of the students who were tested (78 out of 144) were determined to be eligible for participation in the full study and were invited to participate in the research.

Formation of matched groups. Eligible students were matched with same-sex peers based on their gender and baseline level of reading comprehension. Matched groups were formed as follows: Students were separated into two groups based on their gender. Within each gender group, students were ranked according to their SRI scores. Groups of two or three consecutive students (e.g., highest scoring, next highest scoring, third highest scoring) were combined into a same-sex pair or triplet. In cases where students' SRI scores were clustered such that there was a large break between two consecutive scores, triplets were formed so students within similar scores were placed in the same group.

Assignment of participants to experimental condition. Each member of a matched group was randomly assigned to one of the experimental conditions: (1) Control Condition: Computer-based strategy instruction with *no* peer modeling; or (2) Peer Modeling/Influence: Computer-based strategy instruction with *video-taped peer modeling* of thinking questions.

Assigning participants to experimental text. Because the texts were intended to be moderately challenging, participants were generally assigned to read a text that was at least 100L higher than their baseline level of reading comprehension.

All members of a matched group were assigned the same experimental text. Groups in which students scored an average of 650L or less (near a 4th grade reading level) were assigned to the easier problem-solution text on Vampire Bats. This text was rated as having a Flesch-Kincaid readability score of 5.9, equivalent to a high 5th grade level text. Groups in which participants scored an average of 750L or higher (near a 6th grade reading level) were assigned the more difficult text on the John Hancock Tower. This text was rated as having a readability score of 6.9, closer to a 7th grade reading level. Groups within the range from 650L to 750L (within a 5th grade reading range) were assigned to either text.

Reading Sessions

Each student participated in one reading research session which occurred at his or her school and which lasted 45-55 minutes. During this session, the participant was seated in front of a computer terminal with a headset (headphones and microphone) and moved forward at his or her own pace through two reading activities. The researcher, who provided the computers, was present at all times and met with two students at a time.

Activity 1 – Strategy instruction. Participants completed a computer-based, interactive tutorial entitled “Escape from IDunno: How to Learn Better by Asking Real Questions.” In this 5-8 minute activity, they were prepared to use a questioning strategy in which they asked Think & Search, I Wonder, and I’m Confused questions. They first learned about how asking questions could help them better understand a text, then about different types of questions. Next, they read a short passage and example questions generated about that passage. Finally, in a game-like format, they categorized these example questions as Think & Search, I Wonder or I’m Confused questions. (Please see Materials section for a detailed explanation of the strategy instruction and Appendix B for screenshots of this interactive tutorial.)

Activity 2 – Reading with or without peer modeling/influence. In the second reading activity, which took approximately 15 minutes, participants read an expository text of approximately 400 words within a special computer-based environment.

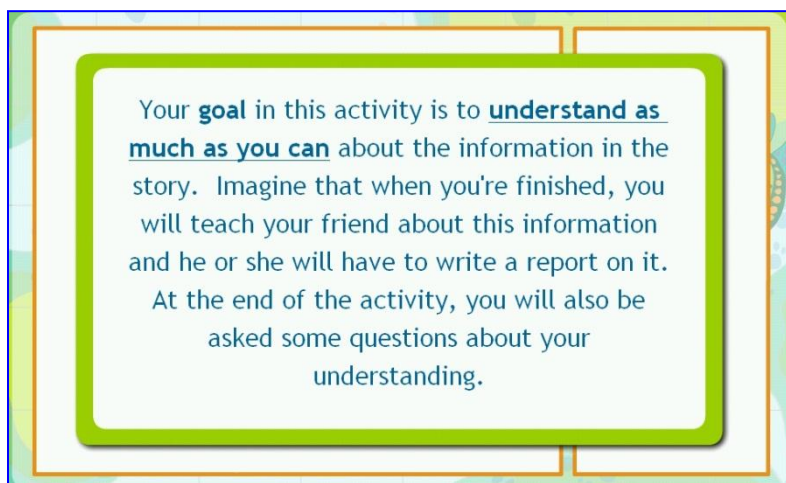
Goals for reading. The students were instructed that their goal in reading was to “understand as much as you can” and were informed that they would be asked comprehension questions when they had finished. Figure 7 provides a screen shot of the goal statement that was presented to participants.

First exposure to peer modeling. After learning the goals for the activity, participants in the Peer Modeling/Influence condition were provided with an embedded video of peer models asking questions about the text that was to follow. A statement introducing the videos indicated:

Here are some Examples of Questions other kids have asked about the text you will read. Please watch and listen to their questions. Afterwards, you will read the story and ask your own questions.

Though participants could pause or replay it, they could not move forward until they had watched the entire video.

Figure 6: Goals for Reading Activity



Instructions. A computer prompt, in text and audio, instructed all participants to “Please read this text aloud. Click on underlined words to get their definitions, and scroll down to see the whole story.” Additionally, the researcher demonstrated to each student how they could get definitions for underlined words by clicking on these words. Vocabulary support was provided in the form of textual and audio definitions and, in some cases, pictures.

Reading aloud. Participants then read aloud the text to which they were assigned. They were audiotaped while doing so.

Second exposure to peer modeling. After reading the text aloud, participants in the Peer Modeling/Influence condition were given the opportunity to again view peer models asking questions about this same text. An introductory statement explained:

Once again, here are Examples of Questions other kids have asked about this story. They thought their questions would help you too. Watch again.

At this time, however, students were able to concurrently view and read through the text.

Silent reading and question prompt. After reading the text aloud with or without the peer modeling intervention, all participants were prompted to read the text again silently and then to record their own questions. Their instructions were:

Please review the story silently and think about Your Own Questions. Write your questions on your worksheet.

Assessments

When participants finished reading, they completed a post-survey, followed by a Structured Oral Interview, and finally the written SVT comprehension assessment. Described in the previous section, these assessments took 15-20 minutes for student to complete. Table 5 summarizes procedures for this experiment.

Table 5: Summary of Procedures for Research Sessions with Students

	Screening Session	Reading Session
Structure	Large group (up to 30 students) in computer lab	Small group (2 students at a time)
Number Students	144 students	78 students in full study 48 students in this dissertation study
Time	Up to 1 hour	45 – 55 minutes
Activities	<ul style="list-style-type: none"> • Scholastic Reading Inventory: On-line Pre-Test of Reading Comprehension • Pre-Survey of Reading Motivation 	<ul style="list-style-type: none"> • Computer-based strategy instruction • Computer-based reading + expository texts +/- peer-modeling • Post-Survey • Structured Oral Interview • Written Comprehension test (SVT)
Materials	<ul style="list-style-type: none"> • Web-based version of SRI • On-line or Paper Survey 	<ul style="list-style-type: none"> • Laptop computers with headsets • Question Worksheet • Paper Survey • Audio-recorder for Structured Oral Interview • Paper SVT Test
Measures	<ul style="list-style-type: none"> • Baseline score of Reading Comprehension • Self-Efficacy ratings • Intrinsic Motivation ratings • Strategy Use ratings 	<ul style="list-style-type: none"> • Student Questions (number, type, quality) • Task Experience ratings • Reading Motivation ratings • Judgment of Learning ratings • Text Comprehension measures

Data Analysis

This section describes the quantitative and qualitative data collected in this experiment and the analytic model undergirding it. It provides details on the procedures used to score qualitative data and statistical methods used to analyze data in the study.

Data

Both quantitative and qualitative data were collected and analyzed in this study. Table 6 summarizes the data that were collected and how these data were used in answering the research questions.

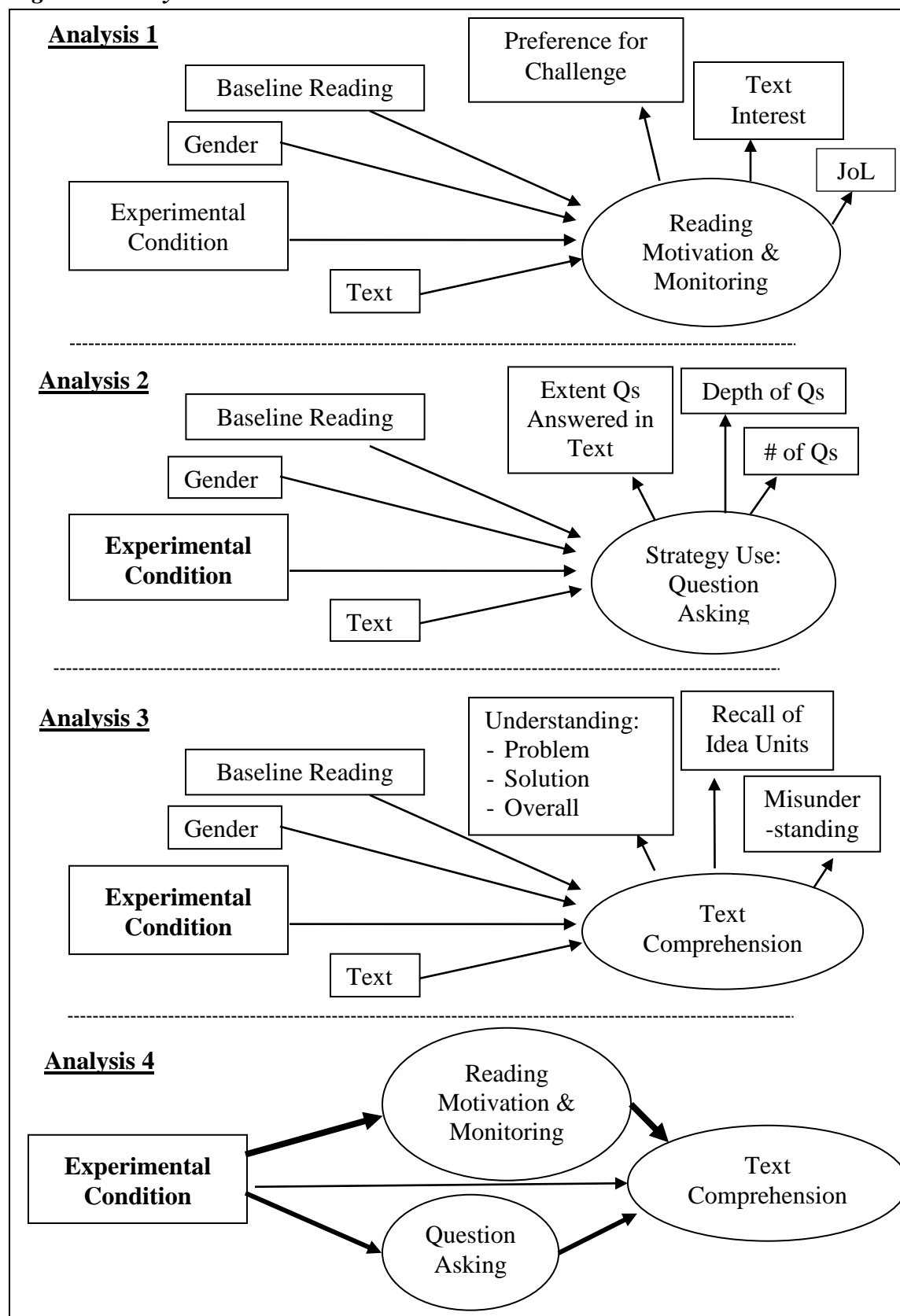
Table 6: Summary of Data Collected

Data Source	Purpose/Use
1. Score on SRI pre-test of reading comprehension	<ul style="list-style-type: none"> • Establish eligibility and equivalency between experimental groups. • Inform assignment into matched groups. • Match to appropriate texts. • Predictor variable for quantitative analyses.
2. Score on Reading Motivation Pre-Survey	<ul style="list-style-type: none"> • Established equivalency between experimental groups. • Assessed as covariate multivariate analyses.
3. Student Questions (recorded on worksheet)	<ul style="list-style-type: none"> • Number, type and quality. • Dependent variable in quantitative analyses of effects of peer modeling. • Independent variable in quantitative analyses of effects of peer modeling on text comprehension.
4. Post-Survey responses: Self-reported ratings of text interest, JOL, text difficulty, perceptions of peer models.	<ul style="list-style-type: none"> • Dependent variable in quantitative analyses of effects of peer modeling. • Independent variable in quantitative analyses of effects of peer modeling on text comprehension.
5. Scores from oral comprehension assessments.	<ul style="list-style-type: none"> • Used to define high-quality questions. • Dependent variable in quantitative analyses of effects of peer modeling.

Analytic Model

As indicated in the study's hypotheses, peer modeling was expected to have a positive effect on participants' reading motivation, self-monitoring of comprehension (as demonstrated by greater accuracy of comprehension judgments), strategy use in the form of higher-quality question generation, and their text comprehension. Additionally, any effects on comprehension were thought to be at least partially mediated by improvements in students' motivation or strategy use. These relationships were tested by MANOVA, MANCOVA and regression analyses. Figure 7 shows the analytic model.

Figure 7: Analytic Model



Data Scoring Procedures

Much of the data collected in this study required coding or scoring before it could be analyzed. Different scoring methods were used for different types of data. These are described below.

Fluency. As described in the Procedures section, participants were recorded as they read aloud the experimental text to which they were assigned. Using the Running Records method, these recordings were scored to assess students' reading fluency and to account for possible differences in text comprehension due to problems with decoding.

The final portion of each text was selected for scoring. For the Vampire Bats text, this portion included 171 words; for the Tower text, it included 175 words. While listening to each participant's oral recording, a researcher marked the number and type of reading errors the student made. Errors consisted of substitutions, omissions and insertions. Repetitions were noted but not considered as errors. Additionally, self-corrections in which participants repaired their reading errors were marked. If a child corrected an error, this error was not counted towards the total errors. Each participant's error rate was calculated by dividing his or her number of uncorrected reading errors by the total number of words in the scoring text.

Question asking. The questions that participants recorded on their Question Worksheets were first entered into a text dataset and then scored by three independent judges. The judges spent approximately six hours in training and practice sessions. During this time, two question coding frameworks were explained, and examples were provided and discussed. Thirty-eight percent of participants' questions were scored during the training and practice sessions; 62% were scored by judges on their own. Inter-rater reliability statistics were computed using the Re-Cal web tool (Freelon, 2010) and are reported in the Results chapter.

Type and depth of question. Each question was coded for question type according to Graesser & Person's (1994) question taxonomy. This taxonomy specifies 16 types of questions and categorizes them as deep, intermediate or shallow. It was possible for questions to receive multiple codes, for example, a question might be Causal Antecedent (deep) in nature but Verification (shallow) in form. In these cases, the highest level question code was used to place the question into a level of depth. It was also possible for participants to submit assertions rather than true questions. Assertions did not count toward the students overall total nor were they scored for depth. Inter-rater reliabilities for question depth are reported in the Results chapter.

Question-text relationship. Participants' questions were also coded for the extent to which they were answered in the text. It was possible for questions to be *directly answered* in the text, in which case the answer was explicitly stated within a sentence or adjacent sentences. Alternately, they could be *indirectly answered* in the text. In these instances, the reader was required to piece together the answer from content that spanned non-adjacent sentences or paragraphs. Finally, questions could be *unanswered* in the text.

Text comprehension. Following their completion of the reading activities, session survey, and SVT assessment, participants were interviewed about their recall and understanding of the text. This Structured Oral Interview was scored, as it was occurring, for Idea Units and Critical Idea Units.

Both components of the Structured Oral Interview—the Oral Retelling and the Oral Main Idea Summary—were also transcribed and scored for accuracy and completeness of problem, solution, and overall passage comprehension. As was the case for question asking, three independent judges scored these three dimensions of understanding. The raters participated in approximately three hours of training meetings in which they discussed and practiced coding

27% of the oral interviews. Seventy-three percent of interview transcripts were coded by the judges on their own. Inter-rater reliabilities for each of the following dimensions of text comprehension are reported in the Results chapter.

Idea unit scores. Based on methods pioneered by Beck, Omanson, & McKeown (1982), the number and type of idea units that participants recalled were counted. Using this method, all the idea units in the passage were first listed and then categorized as critical or non-critical units. Participants received a score representing the number of idea units and critical idea units that they recalled. The scoring of idea units was performed *during* the reading research sessions. As each child recollected the text passage, the researcher checked off which idea units she or he mentioned.

Understanding the problem component score. For each text, three ideas were identified as being essential to understanding the problem. Participants received a score of 0 to 3 depending on how many of these ideas they described accurately and thoroughly. Table 7 details the essential problem and solution ideas for each experimental text.

Understanding the solution component score. Likewise, three ideas were identified as being essential to understanding the solution components of these texts. Again, participants could receive a score from 0 to 3 depending on how many of these ideas they described and explained (see Table 7).

Table 7: Scoring of Problem and Solution Understanding

Text Comprehension Scoring	Text	
	<i>Vampire Bats</i>	<i>John Hancock Tower</i>
Problem Component One point is assigned for each idea the student describes in full	<ul style="list-style-type: none"> • By biting animals to suck their blood (bats suck or drink or eat animals' blood) • Vampire bats were spreading rabies (bats spread rabies or disease) • Rabies caused farm animals to die (farm animals die) 	<ul style="list-style-type: none"> • The glass in the building was breaking or falling off (glass breaking) • Because it was not strong enough (cause = weak/thin glass) • To withstand the strong winds of Boston (cause = wind)
Solution Component One point is assigned for each idea the student describes in full	<ul style="list-style-type: none"> • Scientists developed a shot for the farm animals • This shot makes their blood thick • When bats drink this thick blood, they choke and this causes them to die 	<ul style="list-style-type: none"> • The original glass was replaced with stronger glass • This cost money (amount does not need to be specified) • The tower was completed and is used today

Detail component score. Participants were also given credit if they recounted details about the texts they read. They received a score of “2” if they reported three or more details, a score of “1” if they reported 1-2 details, and a score of “0” if they reported no details in their Structured Oral Interviews.

Overall percent score. Overall percent scores were computed by summing the components and dividing by the total number of points possible. Participants received overall and component scores for their entire Structured Oral Interview as well as for the Main Idea Summary that was part of this interview. The difference between the two was that participants were not probed during the Main Idea Summary. For the final problem, solution and overall comprehension scores, a student’s highest score was used.

Statistical Analyses

Standard statistical analyses were performed on the scored data about question asking and text comprehension as well as on survey data about reading motivation, judgments of learning, and perceptions of peer models.

Descriptive analyses. Descriptive statistics, such as frequencies, means and standard deviations were used to characterize the sample in terms of demographics as well as reading motivation, strategy use and text comprehension. They were also used to screen for outliers in the data.

Correlation analyses. Correlations between question asking and comprehension, motivation and comprehension, and motivation and question asking were performed in order to assess possible covariates for multivariate analyses and predictors for regression analyses. Correlations were also used to identify high-quality question types—those that were positively associated with comprehension.

Multivariate Analysis of Variance (MANOVA). In that gender was not found to be linked with any of the outcome variables, 2 (experimental condition) x 2 (text) MANOVAs were used to assess the effects of peer modeling on question asking and text comprehension.

Regression analyses. To further explain the effects of peer modeling on text comprehension, hierarchical regression analyses were conducted using question asking variables as predictors.

CHAPTER 4: RESULTS

This chapter is divided into nine sections. The first of these describes inter-rater reliability for all of the question asking and comprehension variables that were coded. The second section provides details about the participants and establishes equivalency among the treatment groups. Section 3 presents participants' experiences of the experimental task: It examines their motivation, perceptions of difficulty, judgments of learning, and comprehension calibration.

The fourth section in this chapter describes the types of questions participants asked. The fifth provides information on their text comprehension. In the sixth section, data is shared about the relationship between question asking and text comprehension. Section 7 presents findings about the hypotheses underlying this study—the effects of peer modeling on motivation, question asking and text comprehension. Section 8 places the effect size of this intervention in the context of related interventions that have been reported in the literature. The final section features a contrasting case analysis of four matched pairs of students.

Inter-Rater Reliability

As discussed in Chapter 3, the questions that participants generated as part of the study and their responses to the structured oral interview questions were scored by three independent judges. The judges were blind to experimental condition. Inter-rater reliability statistics were calculated for each of the measures scored, and the results are reported here.

Inter-Rater Reliability for Question Quality Measures

Judges received approximately six hours of training and practice in coding participants' questions. About 39% of questions were scored during these training and practice sessions; 61% were scored independently.

Answered in text. Raters scored the extent to which students' questions were answered in the text. Three codes were possible: *Not Answered* in the text, *Indirectly* answered in the text, *Directly* answered in the text. Questions that were indirectly answered required participants to make inferences across non-adjacent sentences or paragraphs. The average pairwise agreement for these codes was 76%, Krippendorff's $\alpha=0.622$.

Depth of question. Judges first scored each question's type and then rated it as it as deep, intermediate, or shallow based on Graesser & Person's (1994) question taxonomy. The average pairwise agreement for Depth of Question was 90%, Krippendorff's $\alpha=0.816$.

Inter-Rater Reliability for Oral Comprehension Measures

Raters received approximately three hours of training and practice in coding transcripts of participants' structured oral interviews of text comprehension. Just less than 30% of transcripts were scored during these training and practice sessions; 73% were scored independently.

Understanding the problem. Judges rated the accuracy and completeness of participants' description of the central problem of the text. Scores from 0 to 3 were possible on this measure. A score of 3 indicated that the student accurately articulated all three ideas considered essential for a complete description of the problem; a score of 2 indicated that she or he accurately described two of these ideas, etc. The average pairwise agreement for Understanding the Problem was 71%, Krippendorff's $\alpha=0.654$.

Understanding the solution. Judges also rated the accuracy and completeness of participants' description of the solution presented in the text. As with the problem statement, scores from 0 to 3 were possible on this measure, with a score of 3 indicating that the student accurately articulated all three ideas considered essential for a complete description of the solution. The average pairwise agreement for Understanding the Solution was 83%, Krippendorff's $\alpha=0.891$.

Percent overall comprehension. A percent score of overall comprehension was computed from individual scores for understanding the problem, understanding the solution, extent and accuracy of details provided, and mention of the general topic of the text. Possible values for this measure ranged from 0 to 100%. The average pairwise agreement for *exact matches* on Percent Overall Comprehension was 54.3%, Krippendorff's $\alpha=0.806$. The average agreement was 92% for matches representing a one-point difference in ratings.

Misunderstanding of text. Coders rated whether students *misunderstood* key elements of text content. Possible scores were 0 or 1 for this variable. Examples of such misunderstandings included:

- The shot cured the farm animals by killing the rabies germ in their bodies.
- The shot was given to the rabid dogs so that vampire bats would not contract the disease.
- The shot made the farm animals' blood thinner so they would not be affected by the rabies germ.
- The bats became extinct.
- The glass did not fit properly in the windows (it was too small or the wrong shape), and this caused it to fall out on windy days.

- The glass was too thick and brittle, and this caused it to break.
- The building was not repaired and was abandoned.

The average pairwise agreement among raters on this measure of Misunderstanding was 77%, Krippendorf's $\alpha=.578$.

Application of prior knowledge. When participants used terms and/or described concepts *related to but not explicitly mentioned* in the text they read, they were coded as having applied prior knowledge. Examples of applying prior knowledge are indicated later in this chapter. Possible scores for this measure were 0 or 1, and the average pairwise agreement among raters was 66%, Krippendorf's $\alpha=.287$.

Participants

Participants in the study were 48 sixth-grade students who attended public middle schools in New York City in 2011. Sixty-nine percent were girls ($n=33$), and 31% were boys ($n=15$). The mean age of participants was 11.25 years, and all were fluent speakers and readers of English. Twenty (20) were randomly assigned to the Control condition, and 28 to the Peer Modeling condition.

In the middle schools that participants attended, more than 80% of students were eligible for free lunches, and more than 95% for free or reduced-priced lunches. The majority of students at these schools (60-75%) were Hispanic/Latino, and 16-24% were Black/African-American, NYS School Report Cards (2010). Though information was not collected at the student level in this study, these demographics appear to have been mirrored in the sample.

Baseline Reading Comprehension

One to two weeks prior to the start of this experiment, participants were assessed for reading comprehension using the Scholastic Reading Inventory (SRI). Their baseline reading scores ranged from 553L - 818L, with the mean being 706L (SD=67L). Scores in the range of 700-800L are considered on the fifth grade reading level.

The SRI also provides norm-referenced results. In this study, 85% of participants were classified as reading at a “Basic” level (Below Grade Level) and 15% were low but “Proficient” readers (On Grade Level).

There were no differences by gender or by experimental condition in baseline reading comprehension as determined by t-tests. However, as designed, there were differences by text, $t(46) = -4.058, p = .000$. Students reading at a higher level (M=736L, SD=51L) were assigned the slightly more difficult text about the John Hancock Tower. Those reading at a more basic level (M=667L, SD=66L) were assigned to read the Vampire Bats text.

Self-Efficacy for Reading

Baseline levels of self-efficacy for reading were also assessed. On a Pre-Survey of Reading Motivation, 45% of participants *strongly agreed* and 51% *agreed* with the statement, “I think I am a good reader.” Similarly, 40% *strongly agreed* and 46% *agreed* that “I am sure I can understand the texts I have to read for science.” Finally, 71% of participants *strongly agreed* and 20% *agreed* that “I know I will do well in reading this year.” An index of these three self-efficacy items ($\alpha=.623$) was computed: The sample mean for this self-efficacy score was 4.419 out of a possible 5 (SD=.520). T-tests indicated there were no differences in self-efficacy for reading by gender, text or experimental condition.

Intrinsic Motivation for Reading

On this same Pre-Survey, participants responded to several items about the extent to which they read for curiosity and their preference for challenge in reading.

Reading for curiosity. Participants indicated a moderately high level of reading for curiosity. Their mean score on this four-item index ($\alpha=.747$) was 3.31 out of a possible 4 points ($SD=.658$). Notably, 66% of students responded *a lot like me* to the statement, “If the teacher discusses something really interesting, I might read more about it.” More than half (53%) said the same for the statement, “I have favorite subjects that I like to read about,” and 42% reported *a lot like me* in response to, “I read about hobbies to learn more about them.” T-tests confirmed that there were no differences in Reading for Curiosity by gender, text assignment or experimental condition.

Preference for challenge in reading. Sixth graders in the study also had a preference for reading challenging materials. Their mean score on the four-item challenge index ($\alpha=.502$) was 3.18 out of 4 ($SD=.603$). Nearly two-thirds of participants responded *a lot like me* in response to the statement, “I like hard, challenging texts,” and 39% said the same for the statement, “I like it when the questions in books make me think.” There were no differences in Preference for Challenge in Reading by gender, text or experimental condition as determined by t-tests.

Use of Reading Strategies

Participants reported their use of four different reading strategies, including relating texts to their own experiences, self-monitoring of comprehension, question asking, and re-reading. Re-reading was the most commonly used reading strategy among these students: 56% indicated they did this almost always and another 22% said they did this most of the time. Question asking

was the least commonly used reading strategy, with 25% indicating that they almost never or not much asked themselves questions about a text to understand it better and 28% saying that they used this strategy almost always. There were no significant differences in reported reading strategy use by gender, text or experimental condition as determined by t-tests.

Students' use of questioning as a reading strategy was strongly correlated with *Reading for Curiosity*, $r(36)=.503$, $p=.002$ and with *Preference for Challenge in Reading*, $r(36)=.416$, $p=.012$. Question asking was not correlated with self-efficacy for reading.

Fluency

During the reading activity, participants read aloud the experimental text they were assigned. An excerpt of approximately 170 continuous words in each passage was scored for fluency using the Running Records method. Participants appeared to have very little difficulty decoding the texts they read. They ranged in reading accuracy from 88% to 100% with the mean being 96% ($SD=3.2\%$). As determined by t-tests, there were no differences in fluency between boys and girls, or by text or condition.

Participants' Experience of the Task

Immediately following the experimental reading activity, participants completed a short post-survey. Here, they rated how they felt about their reading experience, their level of motivation and judgment of learning (JOL). Findings are summarized below.

Perceived Text Difficulty

The design of this experiment specified that participants be matched with a text that was moderately challenging for them in order to create conditions that might necessitate strategy use.

Despite being matched with a text that was, on average, more than 100L higher than their baseline level of reading comprehension, more than half of participants thought their text was easy to read: 25% rated their text as *Way Too Easy*, and 27% said it was *A Little Easy*. Forty-two percent (42%) rated the text they read as *Just About Right*, and 6% rated it *A Little Hard*.

The mean score for Perceived Text Difficulty was 2.29 out of a possible 4 ($SD=.922$), where higher numbers corresponded to perceptions of greater difficulty. These ratings were *not* significantly correlated with participants' scores on the SRI pre-assessment of reading comprehension, i.e., better readers were not more or less likely to report an easy assignment.

There were no differences between girls' and boys' ratings of Perceived Text Difficulty as determined by t-tests. However, there were trends towards significance for differences between the two texts, $t(46) = -1.994, p=.052$. The Vampire Bats text was rated as easier ($M=2.0, SD=1.049$), than the John Hancock Tower text ($M=2.52, SD=.753$).

Text Interest

Participants were moderately interested in the text they read. On a 5-item index of Text Interest ($\alpha=.725$), the mean rating for all participants was 3.16 out of 4 ($SD=.671$). The index included items such as, "I enjoyed reading this text" and "I would like to learn more about this topic." Similarly, on a single item about boredom, 66% of participants *strongly disagreed* and 28% *disagreed* that "This text bored me to death." T-tests confirmed there were no differences by gender or text in participants' levels of text interest.

Judgment of Learning

Overall, participants were quite confident that they had understood the text they read. On a scale ranging from 0 to 100 percent, students rated how certain they were that they had

understood the main ideas of the text. Their responses ranged from 40% to 100% certain, with the mean being 85% certainty of comprehension ($SD=16.25\%$).

There were no differences between boys' and girls' JOL ratings, as determined by t-tests. However, students who read the Vampire Bats text rated their certainty of comprehension significantly higher than those who read the John Hancock Tower text, $t(46)=2.137, p=.038$. The mean JOL for the Vampire Bats text was 90.5% ($SD=13.2\%$), whereas it was 80.7% ($SD=17.3\%$) for the Tower text.

Accuracy of Comprehension Judgments

A Comprehension Calibration score was calculated for each student to determine the accuracy of his/her self-monitoring of comprehension. This score represents the difference between the student's certainty of understanding and his/her overall oral comprehension score. Using this method, scores around zero ($-.03$ to $.03$) indicate *accurate* comprehension calibration. Scores between $.03$ and 1 indicate *over-confidence*, in which the reader perceives that he understands more than his assessments indicate is the case. Scores less than $-.03$ indicate *under-confidence*, where the reader believes she has understood less than she really has. Categorical scores (accurate, over-confident, under-confident) and absolute value scores were also computed.

Comprehension Calibration scores for this sample ranged from $-.45$ to $.75$, with the mean being $.183$ ($SD=.254$). Sixty-eight percent (68%) of participants *over-rated* their comprehension of the text, and 19% under-rated it. About 13% of participants were accurate in their judgments of comprehension. T-tests of the difference scores and chi-squared tests of the categorical scores confirmed there were no significant differences in Comprehension Calibration by gender or by text.

Interestingly, though, there was a positive and significant correlation between Text Interest and Comprehension Calibration, such that students who were more interested in the text also tended to be over-confident in their understanding of it, $r(47)=.402, p=.005$. ANOVA analyses confirmed this relationship, $F(44,2)=3.319, p=.045$. Table 8 displays differences in the mean interest levels for participants based on their accuracy of comprehension judgments.

Table 8: Relation of Accuracy of Comprehension Judgments to Text Interest

Calibration Accuracy	N	Text Interest: Mean (SD) out of 4
Under-confident	9	2.76 (.790)
Accurate	6	2.90 (.603)
Over-confident	32	3.33 (.611)
Total	47	3.17 (.678)

Preference for Challenge in Future Texts

On the short post-survey, participants were given the opportunity to select the difficulty level of a hypothetical next text. The students believed they might be returning for a second experimental reading session.

More than half (58%) indicated that they would like their next text to be *About the Same* level of difficulty. Thirty-one percent (31%) desired a text that was *A Little Harder*, and 7% wanted one that was *A Lot Harder*. Only two students wanted a text that was easier. As indicated by chi-squared tests, there were no differences by gender or by text in participants' preference for challenge.

Interestingly, among the 25 students who indicated that the text they read was *too easy* (on the Perceived Text Difficulty variable), only 52% said they wanted a more difficult text in the future. Nearly one half of these students wanted a next text that was about the same level of difficulty or easier.

Question Asking

During the experiment, participants recorded their questions about the text on a paper-and-pencil Question Worksheet (see Appendix for an example). They also labeled each question as either a Think & Search, an I Wonder, or an I'm Confused question. These types were defined in a strategy training exercise that all participants completed prior to the reading activity.

- “I'm Confused” questions were defined as: These are *questions about information in the story that does not make sense. Usually, the information disagrees or conflicts with something you believe, know or have read before.*
- “I Wonder” questions were defined as: *Questions about ideas in the text that you are interested in or curious about. They help you create a picture in your mind of what the text is talking about and connect it to things you already know.*
- “Think & Search” questions were defined as: *Questions that can be answered in the story itself. You just have to look across the sentences and paragraphs to find the answer.*

Data on the number and types of questions that participants asked are presented in this section.

Table 9 summarizes these data and provides examples of students' questions.

Incidence of Question Asking

The 48 participants in this study asked a total of 152 questions about the text they read. The number of questions per student ranged from 0 to 5 with the mean being 3.17 questions (SD=1.374). There were no differences by gender or text in the number of questions asked as determined by t-tests.

Participants' Reasons for Question Asking

Curiosity was the most commonly cited reason for participants' question asking: 59% of the questions (n=89) that they asked were identified as "I Wonder" questions. Participants averaged 1.89 "I Wonder" questions each. Confusion, however, was also an important motivation for question generation: 20% of questions were labeled as "I'm Confused" questions (n=31), and participants averaged .66 "I'm Confused" questions each. T-tests confirmed that there were no differences by gender or text in the number of "I Wonder" or "I'm Confused" questions that students asked.

Depth and Types of Questions Asked

Participants' questions were scored for question type and depth using Graesser & Person's (1994) question taxonomy. This framework specifies 16 types of questions and categorizes them as deep, intermediate or shallow. It was possible for a question to receive multiple codes, e.g., a question might be Causal Antecedent (deep) in nature but Verification (shallow) in form. In these cases, the highest level question code was used to place the question into a level of depth.

Depth of questions. In this study, participants asked a surprisingly high proportion of deep-level questions: 60% of the questions they asked were deep-level, 12% were intermediate-level; and 28% were shallow questions. The number of deep-level questions per student ranged from 0 to 5 with the mean being 1.91 (SD=1.265). There were no differences by gender or text in the number of deep, intermediate or shallow-level questions asked.

Types of questions. *Goal Orientation* questions were the most prevalent type of deep-level questions, with 43% of deep questions related to the motives of the agents in or authors of the texts. Twenty percent (20%) of deep questions were *Causal Antecedent*, 19% were

Enablement/Instrumental (process) questions, and 13% were *Expectational*. Only 4% of questions related to *Causal Consequences* of the phenomena described.

Among intermediate-level questions, *Quantification*-type questions were most numerous. *Verification* and *Feature Specification* types dominated the shallow questions.

Question type as related to reason for asking. Among the 31 “I’m Confused” questions that participants asked, 81% were deep-level (n=25), with the majority being Goal Orientation (n=11), Expectational (n=6), and Causal Antecedent (n=5) types. In contrast, 56% of “I Wonder” questions were deep-level (n=50). Goal Orientation-type questions were still prevalent; they comprised 28% of all “I Wonder” questions. However, Verification and Feature Specification question types each constituted about 15% of curiosity-based questions.

Question-Text Relationship

Participants’ questions were also coded for the extent to which they were answered in the text. Just over half of the questions that participants asked (51%, n=82) were *not answered* in the text. Twenty-two percent (22%) were *directly answered* in the text, and 20% were *indirectly answered* in the text. Questions that were indirectly answered required students to make inferences across sentences or paragraphs within the passage. For ten questions (6%), the subject of the question was too ambiguous to determine whether it was answered. On average, participants asked 1.76 questions that were *not answered* in the text.

Table 9: Summary of the Incidence and Types of Questions Participants Asked

Question Type	Number Mean (SD)	Proportion of Total Mean (SD)	Example
Number of Questions Asked	3.17 (1.374)	-	
"I'm Confused" Questions	.66 (.867)	.22 (.287)	I'm confused. If the bat were killing animals, why didn't the farmer keep them [the animals] inside?
"I Wonder" Questions	1.89 (1.220)	.61 (.402)	I wonder why John Hancock building wanted to make his building unique and not the same as other buildings?
Directly Answered in Text	.66 (.788)	.22 (.278)	Why did they want to make a building out of glass?
Indirectly Answered in Text	.62 (.677)	.21 (.271)	Why didn't Pei use wood?
Not Answered in Text	1.76 (1.139)	.51 (.320)	How could wind break the glass?
Shallow Questions	.89 (1.026)	.26 (.312)	Did anybody else make a building out of mirror glass?
Intermediate Questions	.41 (.617)	.11 (.158)	Is the John Hancock Building taller than the Twin Towers?
Deep Questions	1.91 (1.265)	.62 (.362)	How can slightly thicker blood make a vampire bat choke?

Comprehension

In this experiment, both written and oral measures were used to assess participants' text comprehension. Unfortunately, the two written SVT assessments were not reliable measures of comprehension: To assess internal reliability, Cronbach's Alpha was computed for sets of paraphrase and meaning change items in each text. For paraphrase items, these alpha statistics were less than 0.25 for each text. For meaning change items, the alpha statistic was negative for the Vampire Bats text – indicating a *negative* average covariance between items. For the Tower text, it was acceptable ($\alpha=.467$) but very difficult to interpret given the other results. Furthermore, the SVT scores did *not* correlate with any other indicators of understanding or high-quality question asking. As such, data from these written assessments were *not* used in subsequent analyses.

The comprehension data reported in this section all derive from a Structured Oral Interview that was conducted with each participant following the reading activity.

Recall of Idea Units

Recall was measured simply by counting the number of idea units and critical idea units that each participant mentioned when responding to the interview questions.

Number of idea units recalled. There were 46 idea units represented in the Vampire Bats text, and participants recalled average of 15 idea units ($SD=5.550$), about 33% of the total content. Their range extended from 4 to 26 idea units. There were 45 idea units in the John Hancock Tower text, and participants' ranged in their recall from 7 to 19 of these ideas. The mean number of idea units recalled for this text was 12 ($SD=3.351$), about 27% of the total content.

While there were no significant differences in the recall of ideas by gender, the difference by text was significant, $t(46)=2.186, p<.05$. Students who read the Vampire Bats text recalled significantly more ideas than those who read the text about the tower.

Number of critical idea units recalled. Three judges identified the key idea units in each text. Fourteen (14) critical ideas were identified in the Vampire Bats text, and participants recalled from 2 to 9 of these units. Their average was 5.38 critical idea units ($SD=1.910$) or 38% of key ideas.

Eight (8) idea units were identified as being critical to the second text. Participants remembered 2 to 7 of these critical idea units, with a mean of 4.44 ($SD=1.502$), about 56% of the key ideas. There were no significant differences by gender or text in the number of critical idea units recalled as indicated by t-tests.

Completeness and Accuracy of Text Understanding

The students' Structured Oral Interviews were also rated for completeness and accuracy of understanding. From these ratings, participants received three scores – a *problem* understanding score, a *solution* understanding score, and a percent *overall comprehension* score comprised of problem and solution components as well as points for general description of the phenomena and details.

Problem understanding. Out of a possible three points, participants' mean score for problem understanding was 2.36 ($SD=.673$). T-tests confirmed there were no differences by gender or by text in this variable.

Solution understanding. Participants averaged 1.404 ($SD=.970$), out of a possible three points, on their understanding of the solution component of these texts. While there were no significant differences by gender in this variable, there were trends towards significance by text,

$t(45)=2.014, p=.054$. Students who read the Vampire Bat text provided a more complete and accurate description of the solution (mean=1.75, SD=1.208) than those who read the John Hancock Tower text (mean=1.148, SD=.662).

Overall understanding. Participants' percent scores for overall understanding ranged from 25% to 100% correct for these two problem/solution passages, with a mean of 66.8% correct (SD=17.5%). There were no differences in overall understanding by gender or by text as determined by t-tests.

Application of Prior Knowledge and Misunderstandings

In their Structured Oral Interviews, students explained how they understood the phenomena described in the text. In doing so, they often related their prior knowledge to information in the text. When participants used ideas and phrases that were not explicitly stated in the text in their explanations, they were coded as having applied prior knowledge. In many cases, participants' comments also revealed that they had *misunderstood* key concepts in the text. Application of prior knowledge and misunderstandings were coded as either present or absent by three independent raters.

Application of prior knowledge. In their discussion of the passage they read, 74% of participants provided evidence of having applied prior knowledge to their thinking about this text. Examples of this included:

- Realizing that farmers made money off their animals by selling, milking or killing them and this explained their anger: "...and if the farmer doesn't have a lot of animals it's kind of bad business."
- Observing that bats are nocturnal: "...bats sucked their blood like every night because they couldn't come out during the day."

- Noting that scientists do experiments to find solutions: "...they started doing experiments on animals, like, a cow or a horse and gave a shot to it."
- Thinking that being too thick might make the glass brittle and cause it to break in the wind: "...Yes, [the glass was] too thick. Like when your hair is thick and it can break easy, like that."
- Noting that falling glass could cost the company money in lawsuits: "...they had to block off the road just in case so nobody could get hit cause they could get sued for billions of dollars."
- Understanding the practices of architects: "...They had a blueprint and they had to figure out which type of windows to use."

Misunderstanding. More than half of participants (54%) were coded as having misunderstood key elements of the text they read. In that both Misunderstanding and Applying Prior Knowledge were coded as yes/no variables, chi-squared tests were used to assess their independence. These tests indicated there was not a significant relationship between applying prior knowledge and misunderstanding key text elements.

Relation of Question Asking to Comprehension

A key assumption of this study was that asking questions about a text would facilitate its comprehension. To test this assumption, correlation analyses were conducted. Table 10 presents results from the correlations between question asking and text comprehension.

Table 10: Correlations between Question Asking and Text Comprehension

Question Type	Measure of Text Comprehension					
	Overall	Soln	Prob	Misund	IdUn.n	CrtId.n
1. Total number of questions asked	n.s	n.s	n.s	n.s	n.s	n.s
2. <i>I Wonder</i> questions (#)	n.s	n.s	n.s	n.s	n.s	n.s
3. <i>I'm Confused</i> questions (#)	n.s	n.s	n.s	n.s	n.s	n.s
4. Questions <i>directly</i> answered in text (%)	-.348*	-.319*	-.404**	.334*	n.s.	-.342*
5. Questions <i>not</i> answered in text (%)	.304*	n.s.	n.s.	n.s.	.295*	.401**
6. Deep-Level, <i>I'm Confused</i> Questions (#)	n.s	n.s	n.s	-.316*	n.s	n.s
7. Deep-Level Questions <i>not</i> answered in text (#)	.296*	n.s.	n.s.	n.s.	.417**	.414**

Note. N=48. Overall Text Comprehension-Percent Score based on Structured Oral Interview (Overall), accurate understanding of Solution based on Structured Oral Interview (Soln), accurate understanding of Problem based on Structured Oral Interview (Prob), Misunderstanding of Critical Ideas based on Structured Oral Interview (Misund), number of Idea Units Recalled (IdUn.n), number of Critical Idea Units Recalled (CrtId.n)

* $p < .05$, ** $p < .01$

Several noteworthy patterns are evident in these data. First, the absolute number of questions that students ask is not associated with their comprehension. Similarly, neither their reason for asking questions (out of confusion or curiosity) nor the depth of their question asking is directly related to text understanding.

Both of these findings were surprises: We suspected that students who recognized their confusion might be better at self-monitoring their comprehension and, in turn, at repairing errors in understanding. As such, they might achieve greater comprehension. Likewise, we thought

that participants who were curious about the text or asked deep-level questions might be more cognitively engaged with the text, and thereby might reap greater gains in comprehension.

Asking questions that were *directly* answered in the text was negatively correlated with multiple measures of comprehension. Indeed, these types of questions were very strong indicators that participants had *misunderstood* key concepts in the text. This suggests that when students ask questions with answers that are readily found in the text, either they have not carefully attended to the words in the text or they have failed to grasp meaning that is directly conveyed in the text.

In contrast, asking questions that were *not answered* in the text was correlated with greater text comprehension on a number of dimensions. Such questions may indicate that readers have grasped basic concepts in the text and are seeking to extend them. This may be particularly true for *deep-level questions that are not answered* in the text. As expected, these questions were even more strongly associated with comprehension.

Regardless of whether they were deep or shallow, however, questions unanswered in the text were *not* correlated with application of prior knowledge. This was something of a surprise, as we expected that participants with such questions would muse about their answers. Our instruments may have been too coarse to capture these details though.

Finally, students who asked deep-level questions from a state of confusion were *less likely to misunderstand* the text at a gross level. Perhaps these readers were experiencing the benefits of greater self-monitoring of comprehension described above.

Effects of Peer Modeling

Four hypotheses were investigated in this study. Findings are presented below.

Hypothesis 1: Effects of Peer Modeling on Reading Motivation

Hypothesis 1 asserted that participants with exposure to peer modeling would show greater reading motivation than those in the Control Group. *Reading Motivation: Peer Modeling > Control*. This hypothesis was rejected.

Analyses were performed to compare the Control and Peer Modeling groups on motivation. To assess such differences, the index of Text Interest and participants' ratings of preference for challenge in future texts were used as dependent variables. T-tests indicated that there were *no differences* in motivation between the experimental and control conditions.

Hypothesis 2: Effects of Peer Modeling on Comprehension Judgments

Hypothesis 2 asserted that participants with exposure to peer modeling would demonstrate greater accuracy in their judgments of comprehension than those in the Control Group. *Accuracy of Comprehension Judgments: Peer Modeling > Control*. This hypothesis was also rejected.

The calibration difference score and categorical level of accuracy were both used as outcomes in analyses of comprehension calibration. T-tests of difference scores and chi-squared tests of accuracy levels showed no differences in accuracy of comprehension judgments for the two groups. This result was further substantiated by a 2 X 2, experimental condition by text, analysis of variance (ANOVA). This test also showed no significant differences by condition.

Hypothesis 3: Effects of Peer Modeling on Quality of Question Asking

Hypothesis 3 proposed that participants in the Peer Modeling condition would ask higher quality questions than those in the Control Group. *Quality of Question Asking: Peer Modeling > Control*. This hypothesis was confirmed.

Higher quality question types were defined as those having a significant positive correlation with text comprehension. The sheer number of questions participants asked was not associated with comprehension. Therefore, it was not considered in analyses of quality. Similarly, on its own, the level (depth) of question asking did not correlate with comprehension and was not included in subsequent analyses. However, the depth of questioning was an important correlate of understanding when it was considered in tandem with the extent to which questions were answered in the text and with a motivation of confusion.

A 2 x 2 between-subjects multivariate analysis of variance (MANOVA) was performed on the four measures of question asking that were correlated with comprehension: percent of questions directly answered in text; percent of questions not answered in text; deep-level questions identified as “I’m Confused” questions; and deep-level questions not answered in the text. Independent variables were experimental condition (Control and Peer Modeling) and text (Vampire Bats and John Hancock Tower). SPSS GLM procedures were used for the analyses.

Motivational variables were assessed as possible covariates. However, since none of these variables was strongly correlated with any of the dependent variables, no covariates were included in the analyses.

With the use of Wilks’ criterion, the combined DVs were significantly affected by experimental condition, $F(4, 40) = 2.860, p < .05$. They were not significantly affected by experimental text or by the interaction between condition and text.

Further analyses of individual DVs showed a significant effect of experimental condition on deep-level questions not answered in the text, $F(1, 43) = 4.732, p < .05$. Participants in the Peer Modeling condition asked more of these questions ($M=1.26, SD=.984$) than did students in the Control group ($M=.70, SD=.801$).

There were also *trends towards significance* for two other measures of question quality—the number of deep-level questions labeled as “I’m Confused,” $F(1,43) = 3.690, p = .061$, and the percent of questions not answered in the text, $F(1, 43) = 3.247, p = .079$. In both cases, students in the Peer Modeling condition asked more of these questions than did those in the Control group. Table 11 presents data on group means and standard deviations for question asking.

Table 11: Group Means and Standard Deviations for Question Asking

Dimension of Question Asking	Control			Peer Modeling		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Number of Questions Asked	20	3.00	1.376	27	3.29	1.384
<i>Level of Question</i>						
% Deep	20	55.3%	40.6%	27	67.3%	32.4%
% Intermediate	20	11.8%	15.3%	27	9.9%	16.3%
% Shallow	20	32.9%	32.6%	27	21.6%	29.9%
<i>Relation of Question to Text</i>						
% Not Answered in the Text	20	42.7%	32.9%	27	57.2%	30.4%
% Answered Indirectly	20	24.1%	31.7%	27	18.9%	23.6%
% Answered Directly	20	27.3%	29.2%	27	17.5%	26.4%
<i>Motivation for Asking</i>						
% I Wonder (Curiosity)	20	75.2%	28.7%	27	51.1%	34.2%
% I'm Confused (Confusion)	20	15.6%	44.3%	27	26.0%	28.5%
<i>Combined Categories</i>						
Number of Deep Questions Not Answered in the Text	20	0.70	0.801	27	1.21	0.995
Number of Deep Questions labeled "I'm Confused"	20	0.30	0.571	27	0.70	0.869

Hypothesis 4: Effects of Peer Modeling on Text Comprehension

Hypothesis 4 specified that participants who were exposed to peer modeling of authentic question asking would outperform participants in the Control Group on measures of reading

comprehension, especially those related to deeper-level comprehension. *Text Comprehension: Peer Modeling > Control*. This hypothesis was partially confirmed.

The same type of MANOVA was performed on six measures of text comprehension: Overall Comprehension-Percent Score; Understanding of Solution; Understanding of Problem; Misunderstanding of Critical Ideas; Number of Idea Units recalled; and Number of Critical Idea Units recalled.

With the use of Wilks' criterion, the combined DVs were significantly affected by experimental condition, $F(6, 38) = 3.569, p < .01$ and by experimental text, $F(6, 38) = 3.922, p < .01$, but not by their interaction.

Further analysis of the individual comprehension DVs showed that experimental condition had a significant effect on Understanding of Solution, $F(1, 43) = 6.522, p = .014$, and Number of Critical Idea Units recalled, $F(1, 43) = 6.448, p = .015$. Participants in the Peer Modeling Group ($M=1.63, SD=.839$) understood the solution element of these two texts better than their peers in the Control Group ($M=1.10, SD=1.107$). Similarly, students who viewed the peer models recalled more critical idea units than their peers: They recalled an average of 5.26 ($SD=1.72$) in comparison with 4.25 ($SD=1.65$) for the Control group. Participants who were exposed to peer models also recalled more Idea Units overall, $F(1, 43) = 4.074, p = .05$.

Experimental text also had a statistically significant effect on these three comprehension variables. Students who read the Vampire Bats text scored higher than those who read the text about the John Hancock Tower on Understanding the Solution, $F(1, 43) = 5.851, p = .020$, Number of Idea Units Recalled, $F(1, 43) = 5.587, p = .023$, and Number of Critical Idea Units Recalled, $F(1, 43) = 4.107, p = .049$. Table 12 presents group means and standard deviations for text comprehension variables.

Table 12: Group Means and Standard Deviations for Text Comprehension

Dimension of Comprehension	Control			Peer Modeling		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
<i>Recall</i>						
Number Idea Units	20	12.20	4.34	27	14.11	4.77
Number Critical Idea Units	20	4.25	1.65	27	5.29	1.70
<i>Component of Text</i>						
Understanding of Problem (out of 3)	20	2.25	0.64	27	2.44	0.70
Understanding of Solution (out of 3)	20	1.10	1.07	27	1.63	0.84
% Overall Understanding	20	64.7%	19.9%	27	68.4%	15.7%
<i>Misunderstanding</i>						
% with Serious Misunderstanding	20	65.0%	-	27	44.0%	-
<i>Application of Prior Knowledge</i>						
% Applying Own Knowledge	19	74.0%	-	27	74.0%	-

Possible Mechanisms of the Impact

To explain how peer modeling influenced participants' text comprehension, two mechanisms of impact were explored. First, we examined how participants' perceptions of the models may have influenced the effects of these models. Second, we examined to what extent higher-quality questions predicted participants' text comprehension. For these analyses, we included only those students in the experimental condition.

Participants' perceptions of the peer models. Participants who viewed the video segments featuring same-age, similar-ability peer models were asked to rate these models. Specifically, they rated how much they identified with these students and the extent they felt that peer models increased their interest and improved their understanding of the text they read.

Participants also indicated the proportion of the peer models' questions that they tried to answer for themselves

Perceived similarity of peer models. Of the 28 students who viewed peer models, 30% said the peer models were *80% or more Like Me* on a scale of 0 to 100% like me. The mean rating for perceived similarity was 50% Like Me. There were no differences by gender or text in these ratings as indicated by t-tests.

Perceived impact of peer models on interest and understanding. Most participants agreed that peer models improved their interest and comprehension of the text: 85% said the models increased their interest, and 82% agreed that peer models improved their understanding. Out of a possible 4 points where 4 corresponded with a rating of *Agree a lot* and 3 with *Agree a little*, the mean ratings for impact on interest and understanding were 3.15 (SD=.864) and 3.11 (SD=.698) respectively.

Answering models' questions. Just over half of participants in the treatment condition (52%) indicated that they attempted to answer *Some* or *Most* of the questions posed by the peer models. About 11% of students said they did not try to answer any of the peer models' questions.

Attempting to answer the models' questions was *not* associated with participants' perceptions that peer models had improved either their interest or their understanding. However, perceptions of impact on interest and perceptions of impact on understanding *were* highly correlated for these students, $r(27)=.609$, $p<.01$.

Interestingly, participants' ratings of the value of peer models were largely uncorrelated with both their question asking and text comprehension with one exception: Participants who

indicated that they tried to answer the models questions were also more likely to Apply Prior Knowledge in discussing the text, $r(27)=.402, p<.05$.

Higher-quality question asking. Data indicated that participants in the Peer Modeling condition asked higher-quality questions and that higher-questions were generally associated with greater comprehension. To determine the extent to which asking higher-quality questions predicted comprehension scores for students in the Peer Modeling group, we conducted three sets of regression analyses.

Step-wise regression analyses were run independently for each of the three text comprehension measures found to be significantly affected by Peer Modeling – *Understanding of the Solution*, *Number of Critical Idea Units Recalled*, and *Number of Idea Units Recalled*. In these analyses, experimental text was entered as the first block. In the second block, the number of *Deep-level, I'm Confused* questions and the number of *Deep-Level Questions Not Answered in the Text* were entered. Recall that these were the two types of higher-quality questions asked more frequently by students in the Peer Modeling group than those in the Control group.

The results of these analyses indicated that higher-quality question asking did *not* significantly predict text comprehension for any of the three measures of comprehension. However, it is important to note that the ability to see effects in these analyses was certainly limited by the small sample size; there were only 27 cases in the Peer Modeling group which could be included in these analyses.

Effect Size Comparison

Effect sizes for this peer modeling intervention were computed in order to compare it to other initiatives designed to improve the reading comprehension of early adolescents. Effect

sizes for two aspects of text comprehension (Understanding the Solution and for Number of Critical Idea Units Recalled) were calculated by subtracting the Control group mean from the Peer Modeling group mean and then dividing this value by the standard deviation of the Control group.

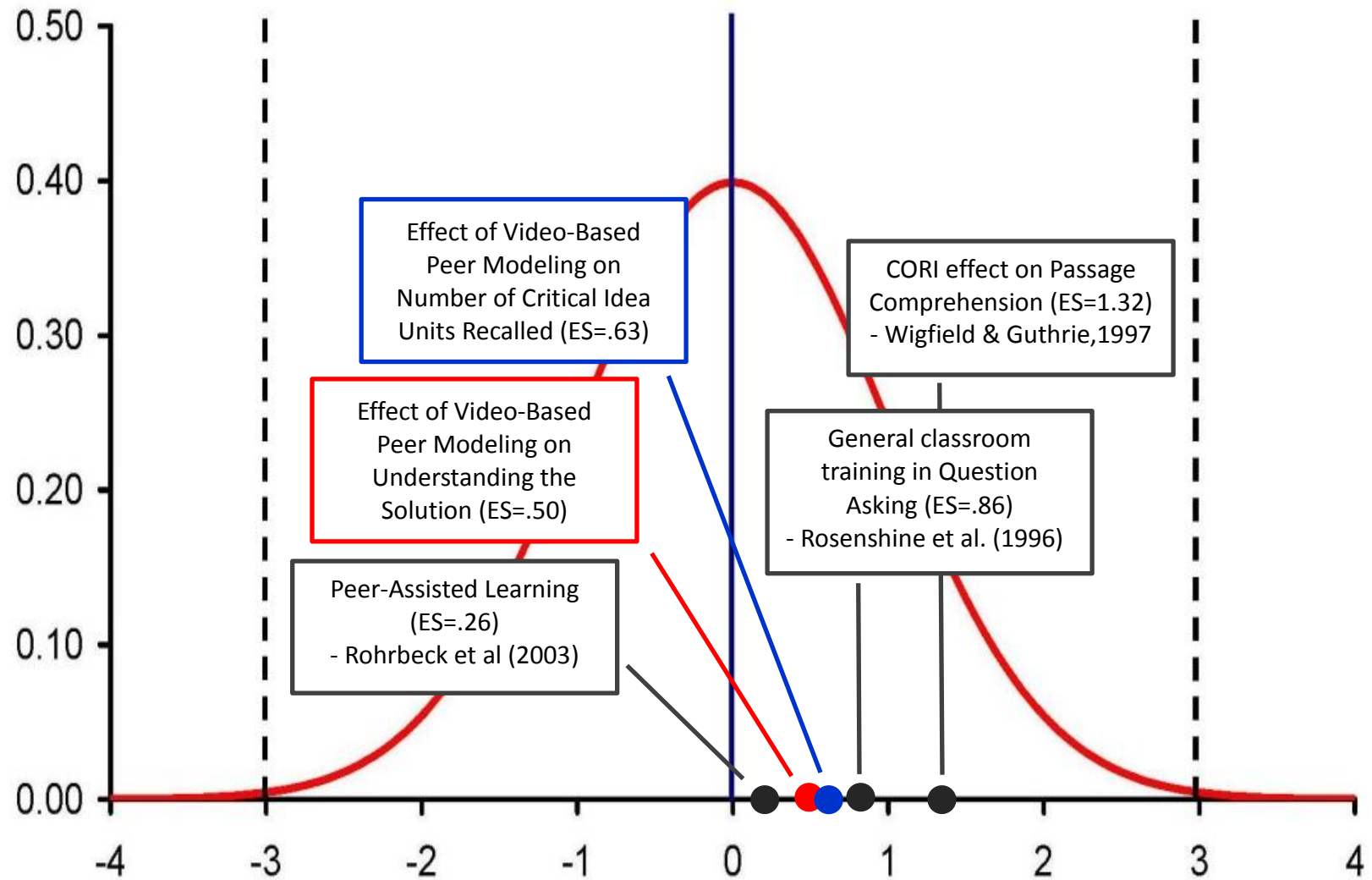
Using this method, the effect size of Peer Modeling of Question Asking on participants' text comprehension was found to be $ES=.50$ for Understanding the Solution and $ES=.63$ for Number of Critical Idea Units Recalled. Effect sizes of .50 and .63 correspond respectively to areas of 19% and 24% above the mean. Therefore, these results indicate that if an average student in the Control group were to receive the Peer Modeling treatment, her text comprehension scores would be expected to improve from 50th to 69th percentile with regard to Understanding the Solution and from 50th to 74th percentile in relation to the Number of Critical Idea Units she recalled.

In comparison, it is useful to consider similar but much longer-term interventions. On the high end, Wigfield and Guthrie (1997) found an effect size of $ES=1.32$ on passage comprehension for the Concept-Oriented Reading Instruction (CORI) program. This intervention promotes the use of multiple comprehension strategies and five practices for motivational support. Typically, the CORI program is administered for 12 weeks in daily, 90-minute sessions and requires considerable teacher training.

Similarly, Rosenshine et al. (1996) found a median effect size of $ES=0.86$ for classroom training in question asking using experimenter-generated reading tests. Training ranged from 4 to 25 sessions.

On the lower end, Rohrbeck et al. (2003) found an effect size of $ES=.26$ for peer-assisted learning. The interventions included in this meta-analysis averaged 45 minutes per week for 15 weeks. Figure 8 summarizes these results.

In summary, the peer modeling technique investigated in this study appears to have had powerful effects on early adolescents' reading comprehension in much less time with much less teacher effort than other initiatives. While the duration of these effects on comprehension is unknown for all of the reported interventions, the results of the research presented here offer promise for effective yet manageable instructional solutions.

Figure 8: Effect Size Comparison

Contrasting Cases

To add descriptive detail to these findings, four contrasting cases are presented. The students featured in these cases were part of the same matched pair or triplet. Their names have been changed in these examples.

Case 1: Brianna and Kayesha - Vampire Bats Text

On the SRI pre-assessment of reading comprehension, Brianna and Kayesha scored 629L and 633L respectively, scores associated with a *Basic* (below grade) level of comprehension. Brianna was randomly assigned to the Control group and Kayesha to the Peer Modeling condition, and both were matched with the Vampire Bats text. Their accuracy rates for reading this passage were 98% and 95% respectively.

After reading it, Brianna and Kayesha both indicated high interest in the text, receiving scores of 3.5 out of a possible 4 on the Text Interest scale. Both reported that the passage was “Way too easy” and each was slightly over-confident in her Comprehension Calibration (.14 for Briana and .13 for Kayesha).

Brianna’s questions. Brianna asked two questions about the text, both of which she labeled as “Think and Search.” Her questions are listed below with spelling and grammar errors preserved.

- Do the vampire [bat] kill humans and animals?
- Is a vampire bat and a bat the same?

The first of these questions is a shallow-level question (Verification) answered directly in the text. The second is an intermediate-level question (Comparison/Verification) that is not answered in the text.

Kayesha's questions. Kayesha also asked two questions, both labeled “Think and Search,” and made one assertion. Her questions, however, were deep-level questions (an Expectational/Verification and a Causal Consequence question) unanswered in the text. These are listed below along with her assertion.

- Could humans also get the shot?
- Couldn't the dog infect other people or dogs just by biting them?
- In the passage, it didn't say if the humans get infected (Assertion)

It is notable that Kayesha focused on the *dog* as a possible vehicle of disease transmission. Though the text was about *vampire bats* spreading rabies, it did mention that the bats caught the disease from dogs. With her question, Kayesha demonstrates that she is forming a more integrative situation model of the phenomenon, one that allows her to see connections that were not stated in the text.

Comprehension. And indeed, in terms of text comprehension, Kayesha outperformed Brianna on every measure. Kayesha recalled 7 critical ideas, scored 88% on the Overall Comprehension assessment, and scored 3 out of 3 on the Solution Comprehension index. Brianna, on the other hand, recalled 4 critical ideas, scored 56% on the overall comprehension assessment, and 1 out of 3 on the Solution Comprehension index. Interestingly, in oral summaries, neither girl supplied evidence of applying world knowledge to the text.

When choosing the difficulty level of a future reading, Kayesha indicated she would like a text that was *A Little Harder*; Brianna wanted one that was *About the Same*.

Kayesha's perceptions of peer models. Because she was in the Peer Modeling condition, Kayesha was also asked to rate the peer models. She indicated that, on a scale of 0 to 100%, the models were 60% like her. She also *Agreed a Little* that the models increased her

interest in the text and improved her understanding of it. She said that she tried to answer *Some* of the questions that the models posed in the video segments.

Case 2: Jonathan and Isidro –Vampire Bats Text

Jonathan and Isidro both scored 645L on the SRI pre-assessment of reading comprehension, weighing in at a *Basic* (below grade) level of comprehension. Jonathan was randomly assigned to the Control group and Isidro to the Peer Modeling condition. Both boys were matched with the Vampire Bats text, and their accuracy rates for reading this passage were 96% and 93% respectively.

After reading the text, Jonathan said he was highly interested in it (3.75/4 on the Text Interest scale); Isidro was moderately interested in it (3.0 on the same scale). Both boys rated the passage as “Way too easy.” Comprehension Calibration scores indicated that Jonathan was slightly over-confident in his assessment of understanding (.18) while Isidro was accurate in his judgment.

Jonathan’s questions. Jonathan asked five questions about the text, three of which he labeled “Think and Search” and two of which he said were “I Wonder” questions. Of the questions, two were deep-level (Causal Antecedent and Enablement/Instrumental), two were shallow-level (Verification and Feature Specification), and one was intermediate-level (Comparison/Verification). Two of his five questions were directly answered in the text, and three were not answered in the text. Jonathan’s questions are listed below with spelling and grammar errors preserved:

- Why do bats have to eat blood
- How can we stop bats from spreading rabies
- can they eat other things

- What is a bats favorite meal to eat
- Can I compare a bats wings with a hawks wings or with just normal birds

Isidro's questions. Isidro asked four questions about the text. He labeled two of these "I'm Confused" questions, one an "I Wonder" question, and one a "Think and Search" question. Three of these questions were deep-level (one Causal Antecedent and two Enablement/Instrumental), and one was shallow-level (Feature Specification). None of Isidro's questions were answered in the text.

- Why are vampire bats so small in size?
- How do bat's find pray [prey] if there [they're] blind?
- How can slightly thicker blood make a vampire bat choke?
- Can a bat tell if a animal has rabies?

Isidro's questions, particularly the two Enablement/Instrumental questions on *how* things happen (those two were also the "I'm Confused" questions), suggest that he was truly grappling with the ideas in the text, trying to imagine how things operated in the system and forming a situation model of the phenomenon.

Comprehension. As in the previous example, Isidro (from the Peer Modeling condition) outscored Jonathan (from the Control group) on every measure of text comprehension. Isidro recalled 6 critical ideas, scored 100% on the Overall Comprehension assessment, and scored 3 out of 3 on the Solution Comprehension index. In contrast, Jonathan recalled 3 critical ideas, scored 44% on the overall comprehension assessment, and 0 out of 3 on the Solution Comprehension index. In their oral summaries, both boys supplied evidence of applying world knowledge to the text.

When choosing the difficulty level of a future reading, Isidro indicated he would like a text that was *A Little Harder*, and Jonathan wanted one that was *About the Same*.

Isidro's perceptions of peer models. Isidro did *not* feel that the peer models were much like him; he rated them as 10% similar. Nonetheless, he *Agreed a Lot* that the models increased his interest in the text and *Agreed a Little* that they improved his understanding of it. He also said that he tried to answer *Most* of the questions that the models posed in the video segments.

Case 3: Desiree and Jacklyn – John Hancock Tower Text

Desiree and Jacklyn scored 710L and 696L respectively on the SRI pre-assessment of reading comprehension, both at a *Basic* level of comprehension. Desiree was randomly placed in the Control group and Jacklyn in the Peer Modeling condition. Both girls were matched with the John Hancock Tower text.

After reading the text, Desiree indicated she was *highly uninterested* in it (1.0/4 on the Text Interest scale) while Jacklyn was *moderately interested* in the passage (3.25 on the same scale). In terms of perceived difficulty, Desiree said the text was “Way too Easy” whereas Jacklyn thought it was “A little Easy.” Comprehension Calibration scores indicated that both students were *under-confident* in their assessments of their understanding, with a score of -.18 for Desiree and -.08 for Jacklyn.

Desiree's questions. Desiree asked only one question, an “I Wonder” question. This was a deep-level question (Goal Orientation) that was not answered in the text. Her question was: Why did he want to build a skyscrapers?

Jacklyn's questions. Jacklyn asked two questions about the text (both “I Wonder” questions), and she made one assertion. One of her questions was deep-level (Goal Orientation) and one intermediate (Comparison). Neither was answered in the text. Jacklyn's questions were:

- I wonder if the Empire State Building was built after the John Hancock Building?
- I wonder why John Hancock building wanted to make his building unique and not the same as other buildings?
- I think that John Hancock should be careful with the glass that he gets. (Assertion)

Jacklyn's comparison question indicates she is putting the John Hancock Tower (purportedly the tallest skyscraper in Boston) in the context of other tall buildings she knows. As such, it suggests she is actively engaging with ideas in the text.

Comprehension. Although Jacklyn's baseline reading level was slightly lower than Desiree's, she scored higher on all measures of text comprehension in this experiment. Jacklyn recalled 7 critical ideas, scored 88% on the Overall Comprehension assessment, and scored 2 out of 3 on the Solution Comprehension index. Desiree, in contrast, recalled 6 critical ideas, scored 78% on the overall comprehension assessment, and 1 out of 3 on the Solution Comprehension index.

In their oral summaries, both girls supplied evidence of applying world knowledge to the text. Similarly, both indicated that they would prefer a text that was *A Little Harder* for future readings.

Jacklyn's perceptions of peer models. Jacklyn felt that the peer models were somewhat like her; she rated them as 50% similar. She *Agreed a Lot* that the models increased her interest in and understanding of text. She also said that she did try to answer some but *Not Many* of the questions that the models posed in the video segments.

Case 4: Andre and Sherwin – John Hancock Tower Text

Andre and Sherwin scored 766L and 755L respectively on the SRI pre-test—both at a *Basic* level of reading comprehension. Andre was randomly placed in the Control group and Sherwin in the Peer Modeling group; both read the John Hancock Tower text.

After reading the text, both boys indicated they were *mildly uninterested* in it (2.75/4 on the Text Interest scale). Andre thought the difficulty level of the text was “Just about Right” whereas Sherwin thought it was “A little Easy.” Comprehension Calibration scores indicated that Andre was highly *over-confident* in his assessments of comprehension (.40), whereas Sherwin was nearly accurate in his judgment (.03).

Andre’s questions. Andre asked three questions about the text, two “I’m Confused” and one “I Wonder” question. Two of his questions were deep-level (Causal Antecedent and Goal Orientation), and one was intermediate (Quantification). His questions were:

- Why did the glass kept on breaking?
- Why did they make a building out of glass?
- How much money John Hancock company had it to pay for the damage? [to replace the glass]

All of Andre’s questions are answered directly in the text. The fact he asks them and is confused about their answers may indicate that he did not read the text carefully.

Sherwin’s questions. Sherwin asked three questions about the text, one that he labeled as “I’m Confused” and two as “I Wonder.” One of his questions was deep-level (Goal Orientation) and two were shallow (Verification). One question was answered indirectly in the text; the others were not answered. Sherwin’s questions were:

- Why do they use that kind of glass if they knew about the strong winds of Boston

- Did the glass hurt anyone
- if so were they badly injured

The first of Sherwin's questions indicates that he understands the problem in this text but that he is incredulous as to why the architects did not plan properly. This question is very indirectly answered in the text by a statement indicating that the architects realized they had made a mistake when they did not account for the strong winds in their planning.

Comprehension. Sherwin outperformed Andres on all measures of text comprehension. He recalled 5 critical ideas, scored 67% on the Overall Comprehension assessment, and scored 2 out of 3 on the Solution Comprehension index. Andres, on the other hand, recalled 3 critical ideas, scored 50% on overall comprehension, and 0 out of 3 on the Solution Comprehension index. In their oral summaries, neither student supplied evidence of applying world knowledge to the text. In a pattern slightly different than other examples, Andres preferred a text that was *Little Harder* for future readings, whereas Sherwin wanted a text that was *About the Same*.

Sherwin's perceptions of peer models. Sherwin did not feel that the peer models were like him; he rated them as 30% similar. However, he *Agreed a Little* that the models increased his interest in and understanding of text. He did not try to answer any of the questions that the models posed in the video segments.

CHAPTER 5: DISCUSSION

This chapter is structured around four topics. The first explores reviews major findings about the effects of peer modeling and probes mechanisms for these effects. The second discusses surprises in the data, along with possible explanations and implications, and the third describes strengths and limitations of the study. The final topic addresses general implications of this research for both theory and the design of computer-based learning environments and suggests directions for future research.

Overview of Major Findings about Effects of Peer Modeling

In this study, video-based peer modeling of question asking was found to have had a significant effect on both question asking and text comprehension. It had no effect on motivation or accuracy of comprehension judgments.

Lack of Effect of Peer Modeling on Motivation and Comprehension Calibration

More than three-fourths of participants in the Peer Modeling condition *agreed a lot* (37%) or *agreed a little* (48%) that the peer models “made me more interested in the text.” However, there were no significant differences between students in the treatment and control groups on any measures of motivation.

Further analyses indicated that the 10 students who *agreed a lot* that peer models improved their interest did, in fact, also report being significantly less bored. Additionally, their ratings of greater Text Interest trended towards significance. Of these 10 students, four were boys and six girls; four read the text on vampire bats and six read the passage about the John Hancock Tower. Their mean SRI score was 702L, slightly below the mean for the entire sample.

All of these participants preferred a future text that was *about the same or a little harder*, and more than half of their questions (56%) were *not answered* in the text. Nine of the ten were *overconfident* in their comprehension calibration. However, as a group, they scored above average (had z-scores greater than zero) on three of the four key indicators of comprehension; the only measure of comprehension on which they were slightly below average was Understanding the Solution of the text.

These findings suggest that peer modeling may, indeed, have had some effects on motivation, but that these effects were *non-uniform* across the treatment group and therefore less visible in the analyses. In other words, some students in the treatment group may have been more susceptible to the effects of peer influence on reading comprehension than others.

It is not clear why this was the case. However, the data offer some provocative hints. Firstly, differences in perceived similarity of models may be ruled out as an explanation for the differential effects of models on motivation. Both groups identified with the models. Though the ten students in the high impact on motivation group rated the models as being more similar to themselves and their friends, there were no significant differences between the two groups in perceived similarity of the peer models.

On the other hand, attempting to answer peer model's questions may have improved participants' motivation for reading. For students who reported greater impact of peer modeling on interest, there were trends towards significance in trying to answer more of the models' questions, $\chi^2(3)=6.907, p=.075$. Half of the 10 students who *agreed a lot* that the peer models made them more interested in the text also said they tried to answer "most of the questions" that the models asked. In contrast, only 12% of other participants in the treatment group tried to answer *most* of the models' questions.

It is unclear whether these students tried to answer more questions because they were more interested or whether they were more interested because they attempted to answer more of the models' questions. Whatever the case, these findings may suggest an important pathway to impact.

Effects of Peer Modeling on Question Asking

Exposure to peer models significantly improved the quality of questions that struggling sixth-grade readers asked about the expository science texts they read. As noted in the previous chapter, peer modeling had a positive effect on the number of deep-level questions unanswered in the text that students asked. It also had a near-significant positive effect on the number of deep-level, "I'm Confused" questions and the percent of questions unanswered in the text asked by readers.

Recall that deep-level questions involve causes, consequences, processes, and alternative courses of action. Asking deep-level questions about *text-explicit* information suggests that readers have not really understood what they read or, perhaps, that they are quizzing themselves to enhance recall. Asking deep-level questions that *cannot be answered in the text*, however, implies that readers are truly engaging with the content of the text—attempting to self-explain the text phenomena in ways they will understand. Similarly, asking deep-level questions from an acknowledged state of confusion means that readers have identified that information in the text disagrees with what they thought to be true. As such, it means that they are comparing the image presented in the text with that in their minds and that they are inquiring about the discrepancies. Both of these types of questions connote deeper-level thinking.

How, though, does simply watching peer models ask questions of a text promote deeper thinking and higher-quality question asking? Several explanations are possible.

Social motivation. It was hypothesized that observing same-age, similar-ability peer models ask smart and authentic questions, would motivate struggling readers to do the same, i.e., that the models' enthusiasm and genuine inquisitiveness might be contagious in some way. In that there were no significant differences in motivation between the treatment and control groups, this may not be the case. However, it is also possible that the motivational constructs measured in this experiment (text interest and preference for challenge in future assignments) were *not* the appropriate ones to assess this mechanism.

Anderson and his colleagues (2001) describe a parallel phenomenon that they term the “snowball phenomenon.” They note that once a useful stratagem has been used by a child during a discussion, it tends to spread to other children and occur with increasing frequency.

Social norms correction. It was surmised that when students saw other kids (who they perceived as similar) genuinely engaging with the texts and asking substantive questions, they would “correct” their ideas about behavioral and attitudinal “social norms” of reading. Consequently, they would ask more and better questions.

Peers are the greatest influencers of adolescents' day-to-day behaviors in school, e.g., how much time they spend on homework and their classroom behaviors (Steinberg, Dornbusch & Brown, 1992; Steinberg, Brown & Dornbusch, 1996). As such, it is reasonable to infer that peers may also communicate and enforce norms around reading behaviors. Though the data in this experiment did not permit us to examine this explanation for the effect of peer modeling on question generation and depth of thinking, it is certainly worthy of further study.

Examples of good question asking. Students may not develop good question-asking skills because they lack good role models to demonstrate the techniques (Graesser & Person,

1994; van der Meij, 1998). Perhaps the peer models in this experiment provided the good examples that participants lacked and enabled them to ask higher-quality questions.

Greater attention to the text through more frequent look-backs. Listening to the questions that peer models asked may have provoked readers to *look back* to the text more frequently to see what the models were talking about. In doing so, they may have processed the text more attentively and, thus, may have asked higher-quality questions. In research about QARs training with sixth graders, Rafael and Pearson (1985) propose a similar explanation for the positive results they observed.

Greater exposure to text content. Likewise, the models' questions served to repeat certain content in the text. As such, they may have provided participants in the experimental group with more exposure to text content. This explanation, however, is less tenable than others: As discussed previously, the Peer Modeling group displayed greater comprehension primarily in understanding the *solution* component of the text. Since very few of the models' questions involved the solution, it is not likely that greater content exposure created an advantage for the Peer Modeling group.

Triggering cognitive disequilibrium. Cognitive disequilibrium occurs when learners experience obstacles to goals, anomalous events, contradictions, discrepancies, and/or obvious gaps in knowledge (Graesser, Lu, Olde, Cooper-Pye, & Whitten, 2005; Otero & Graesser, 2001). These disparities often create a state of confusion. To resolve them and restore cognitive equilibrium, readers may engage in extra processing; they may ask better questions and think harder about the text content.

It is possible that peer models triggered cognitive disequilibrium. They may have done so by themselves expressing confusion or by demonstrating attempts to restore equilibrium

through their question-asking. Alternately, simply hearing other students' questions may have helped the readers in this experiment become more aware of aspects of the text that did not make sense to them either.

Effects of Peer Modeling on Text Comprehension

Participants in the Peer Modeling group outperformed those in the Control condition on three of six measures of text comprehension: Understanding the solution; number of critical idea units recalled; and number of idea units recalled. Of all the components of comprehension that were assessed in this study, constructing a complete and accurate understanding of the solution required the greatest amount of inferencing. Consequently, it was particularly noteworthy that students in the Peer Modeling condition scored better on this dimension.

In the design of this research, three pathways were conceptualized to account for possible effects of peer modeling on text comprehension—a motivational pathway, strategy use pathway, and attention pathway.

Enhanced motivation. In the motivational pathway, it was posited that increased intrinsic motivation (preference for challenge, involvement and curiosity – the latter two combined into an index of Text Interest due to high correlations) would facilitate greater text comprehension.

As discussed in the previous section, peer modeling did appear to have positive effects on motivation for a certain subset of participants (those who strongly agreed that the models made them more interested). Additionally, these effects were associated with greater comprehension on some of the components of comprehension, but not Understanding the Solution.

Overall, however, the effects on motivation were not uniform across the treatment group, and there were no significant differences between students in the Control and Peer Modeling

groups on any motivational variable. Consequently, the motivational pathway does *not* appear to be a plausible explanation for the effects of peer modeling on participants' text comprehension.

Better strategy use. A second possible pathway specified that participants in the Peer Modeling group would make more effective use of question asking as a reading comprehension strategy and this, in turn, would promote greater comprehension.

MANOVA analyses confirmed that students who observed peer models did indeed ask higher-quality questions (see discussion above). However, in subsequent regression analyses, these higher-quality questions were *not* found to be significant predictors of any of the three indicators of text comprehension that were influenced by peer modeling. As such, this second pathway may also not explain the effects of this study.

Greater attention to text content. A final pathway asserted that observing peer models would provoke students to pay more attention to the text, to simply engage more with actual text content. This pathway included the possibility of an increased frequency of look-backs (described in the previous section). It also encompassed the idea that by repeating text content in their questions, peer models might prompt readers to re-read or review that particular content and perhaps the text surrounding it.

For the text on vampire bats, none of the peer models' questions directly addressed the solution component of the text. However, for the John Hancock Tower text, one of six questions asked by peer models did involve the solution component of the text. This question was, "Why did it cost seven million dollars to replace the glass?" The effect of peer modeling on Understanding the Solution was much greater for students who read the Vampire Bats text, in which peer models did not ask directly about the solution component, than for those who read the Tower text. The mean score for participants who read the Vampire Bats text and were

exposed to peer modeling was 2.30 (SD=.675) out of 3.0 while that of the Control group was 1.20 (SD=1.399). In contrast, for the tower text, the mean score for participants in the treatment group was 1.235 (SD=.664), whereas the score for the Control group was 1.00 (SD=.667). Consequently, it is unlikely that participants in the Peer Modeling condition better understood the solution because solution-related text content was repeated in questions by the models.

It was not possible to directly test this attentional pathway with available data. However, I did compare participants (in the treatment group) who said that they tried to answer *most* of the models' questions (n=7) with those who only answered some, a few, or none of the questions. Trying to answer most of the questions would seem to imply greater attention to the text. There were no significant differences in text comprehension between these two groups, but it is possible that low power impeded the ability to see differences.

From these data, it is difficult to explain how peer modeling exerted its influence on participants' text comprehension. Should the findings be reproduced, though, it would be wise to further explore these pathways.

Surprises in the Data

There were several surprising findings in this study. In this section, I examine these surprises in more detail. Possible explanations and their implications are discussed.

Incidence of Deep-Level Question Asking

Previous research has reported a very low incidence of question asking and, particularly, deep-level question asking among students in classroom and tutoring settings (Dillon, 1988; Graesser & Person, 1994). In this study, however, *struggling sixth-grade readers* asked an

average of 3.17 questions within about 20 minutes. Furthermore, 60% of the questions they asked were deep level—primarily about goal orientations, causal antecedents or processes.

There are several reasons that these lower-performing readers may have asked so many questions and deep-level questions. These explanations can help to refine theory about reading strategies and about the particular reading difficulties of struggling adolescent readers.

Reduction of social barriers. It is possible that the social structure of the experimental task—the fact it was a solo rather than a classroom or small group activity—may have reduced barriers to question asking that are normally present. In this setting, students did *not* face the ego risks of “revealing ignorance” when they asked questions.

Text features. Alternately, features of the text such as its structure (problem/solution) or its relative level of difficulty (within the ZPD of the reader) might have promoted question asking. While this explanation cannot be directly tested with the current data, we did find that there were no differences in the number of questions or deep-level questions based on participants’ perceptions of the text difficulty. This suggests that ZPD, at least as judged by students’ ratings of difficulty, might *not* be an accurate explanation of the high incidence of questions.

Text interest. By and large, readers in the experiment were interested in the expository science texts that they read. Recall that the mean Text Interest index score for the sample was 3.10 out of 4. In these data, there was a nearly significant, positive correlation between text interest and the number of questions that students asked, $r(47) = .282, p = .052$, but there were no associations between interest and higher quality questions. These findings suggest that while interest may have a role in promoting students’ question generation, it does not necessarily support them in asking the sorts of questions that will improve their text comprehension.

Question strategy instruction. Prior to the start of this experiment, 50% of participants reported that *most of the time* or *almost always* “I ask myself questions about what I read to help me understand it better.” These students may have learned question generation as a reading comprehension strategy in their English Language Arts (ELA) or science classes and may have simply been using what they had learned in this study. Alternately, as part of the study, all participants completed a short interactive tutorial on question asking as a means of improving comprehension. As a result of this lesson, perhaps they were primed to generate more questions.

Ability level. In a cross-sectional study of 22 classrooms, Good et al. (1987) found that lower-achieving students, in comparison with higher achievers, asked fewer questions in general and fewer academic questions in particular. In contrast to these findings, my study demonstrated that lower-performing sixth graders were quite capable of asking questions and high quality questions. Indeed, one may speculate that these students are lower performing in part *because* they do have so many questions about what they read.

In reviewing students’ individual questions, it was striking just how many of them were goal orientation questions: They were about *why* the author, the architect, the vampire bats, the farmers did what they did. These questions may point to a lack of prior knowledge about the subjects, but they also present a teaching opportunity. Perhaps, questions about motive should be routinely and explicitly raised in discussions of texts – even science texts.

Perceptions of Text Difficulty

Though participants were matched with texts that were intended to be slightly difficult for them, over half of them thought the texts they read were too easy. Possible explanations for this phenomenon are: (1) The SRI pre-test of reading comprehension did not provide an accurate assessment of their skill level (perhaps they did not take the test seriously when it was

administered); or (2) students did not have an accurate sense of the extent to which they understood the texts.

While there were not *significant* differences in accuracy of comprehension judgments based on the students' perceptions of text difficulty, there were some interesting trends. One-third of participants who rated their text as *way too easy* were *accurate* in their judgments of comprehension. This percentage was far higher than expected, but the size of the subgroup was too small for conclusions to be drawn.

Role of Motivation in Text Comprehension

The positive relationship between intrinsic motivation and reading comprehension is somewhat well documented in the literature. For example, in a study of fourth-graders from the U.S. and Taiwan, Wang & Guthrie (2004) found a positive association between motivation and text comprehension for both groups of students after controlling for past reading achievement. Data indicated that enjoyment of reading, involvement in reading, and preference for challenge were all positively correlated with the students' comprehension of narrative texts.

Other research, however, has suggested that the effects of motivation are not consistent across students. For instance, in Unrau & Schlackman's (2006) study of 2,000 economically-disadvantaged students in a California middle school, *none* of the motivational subscales (the same ones used in the Wang & Guthrie research) positively correlated with achievement for Latino students. The authors explained this has having to do with cultural norms affecting academic motivation.

My study included separate measures for text interest, enjoyment, curiosity, boredom and preference for challenge. The first three of these were highly correlated, though, and therefore

were combined into a single index of Text Interest. Preference for challenge and boredom, both single items, were analyzed independently.

As with the Unrau & Schlackman (2006) study, I found *no significant, positive correlations* between motivation and text comprehension for the ethnically diverse sixth-graders in my sample. However, I did find some other noteworthy patterns.

Comprehension calibration. Higher interest was associated with *lower* accuracy in comprehension calibration. Participants who were over-confident in ratings of their comprehension also reported significantly higher interest in the text, $t(46)=-2.587, p<.05$. The average Text Interest index score for over-confident readers was 3.28 out of a possible 4 ($SD=.637$) whereas accurate and under-confident participants averaged 2.75 ($SD=.735$).

Question quality. Higher interest was *not* associated with higher-quality questions for this sample. As reported above, there was a trend towards significance for students with higher interest to ask more questions, but these were not necessarily higher quality questions.

There was, however, an interesting relationship between participants' preference for challenge in future texts and their question generation: Students who preferred texts that were easier or about the same as the ones they had read also tended to ask more "I Wonder" questions, $F(2,41)=3.846, p<.05$. In other words, participants who desired more difficult texts asked fewer of these questions. Though "I Wonder" questions were not associated with greater comprehension, they may provide insight into the students' thinking processes, e.g., perhaps by asking such questions, these students are removing themselves from actual text content by allowing their minds to wander to somewhat related topics but ones that may not aid comprehension.

Role of Question Asking in Text Comprehension

There is strong evidence in the literature that asking questions of texts can support reading comprehension for all types of students (Graesser, Singer, & Trabasso, 1994; Pressley, McDaniel, Turnure, Wood, & Ahmad, 1987; Rosenshine et al., 1996; Seiffert, 1993).

Additionally, there is some indication that question generation may have a more positive and pronounced effect for students who are near grade level in decoding but poor in comprehension (Rosenshine, Meister, & Chapman, 1996).

Data from this experiment, with lower-performing sixth-grade readers, showed a positive and significant relationship between *certain types* of questions and text comprehension. However, there was *not a direct association between deep-level questions and comprehension*, and this was a surprise.

Deep-level questions are characterized by the patterns of thinking they elicit. They involve integrating new and prior knowledge, reorganizing mental models, generating inferences, and monitoring comprehension. Such questions are often about causality and/or mechanisms and motives for action (Dillon, 1984; Graesser & Person, 1994; Roscoe & Chi, 2007). As such, one would expect them to be strongly related to comprehension.

In my study, deep-level questions were only related to comprehension when they were not answered in the text or when they originated from a state of confusion. On their own, they were unrelated to more complete and accurate understandings of the text. Additionally, questions at any level of depth that were *directly* answered in the text were systematically and *negatively* associated with comprehension.

These findings suggest that, for struggling adolescent readers, the level of question asking on its own may not be an accurate indicator of understanding. Instead, teachers and researchers

may need to examine students' questions in the context of how they are making use of information in the text. Insofar as questions represent students grappling with and extending specific ideas in the text, they may also represent deeper levels of thinking and lead to greater comprehension. When students' questions indicate that they are looking for information that is explicitly available in the text (i.e., engaging in a process similar to completing a fill-in-the-blank pop quiz), these questions do *not* promote comprehension.

Strengths and Limitations

Before discussing the implications of these findings for practice and research, it is worthwhile to mention a few strengths and limitations of the work.

One strength of the study was its use of multiple measures of motivation, question quality and reading comprehension. These constructs are not monolithic, and using multiple measures (e.g., depth of question and extent to which it could be answered in the text) ensured that their complexity was represented and assessed. Additionally, the research included more than one experimental text, suggesting that findings might be generalizable across problem-solution expository texts. Finally, the study targeted an important segment of adolescent learners – struggling readers – with an intervention that was designed specifically for them.

There were also several limitations to the research. First, the experiment was conducted with a relatively small sample, 48 participants. With a larger sample, it may have been possible to elucidate the mechanisms by which peer modeling exerted its influence and to better interpret surprising findings about motivation. Secondly, the study measured question asking and comprehension at only point in time. As such, there was no way to assess the extent to which

peer modeling had any kind of sustained impact on participants' question asking and comprehension.

Finally, there were a few notable threats to the internal validity of this study. Foremost among these is that, with the current experimental design, it is not possible to determine whether treatment effects are due to *peer* modeling of question asking or merely to the fact that participants were provided with *examples of questions* related to the texts they read. To distinguish between these two possibilities, future research should include a Control group that does not involve peer models but rather presents example questions for participants to read.

It should be noted, however, that in pilot research, participants almost always referenced the importance of *kids* asking the questions. For example, one participant commented that "Usually when people try to persuade me to do something [like read boring things], I do the opposite. But this was different. These kids' questions grabbed me and they made me want to think." Another child said, "When teachers ask questions, they already know the answers. But when kids ask questions, you know they really want to know the answers and you want to help them find the answers to their questions. This makes you start having your own questions."

Another threat is that the experimental treatment lasted longer than the Control. Consequently, students in the Peer Modeling group spent 5-8 more minutes engaging with the text than their counterparts in the Control condition. This increased exposure to text content may have explained some of the treatment effects on text comprehension.

A final, though less likely, threat to the internal validity of the study was that providing examples of questions before and after participants read a text may have provided them with an *advanced organizer* and a *review* of text content. Both of these devices are known to improve text comprehension. However, because the peer models' questions were not presented in a

manner that paralleled the structure of the text nor were they clearly labeled as relating to the problem or the solution, it is unlikely that they met the criteria to be considered a cogent advanced organizer or review.

Implications and Directions for Future Research

Despite these limitations, the results of this study have implications for better understanding the experiences of struggling adolescent readers, for building theory around reading comprehension and reasoning, and for the design of computer-based learning environments.

Understanding Struggling Adolescent Readers

Two surprises in the data may help us better understand low-performing readers such as these sixth graders. The first surprise is that the students asked a high proportion of deep-level questions but that these why, how, what for, and what if questions were *not* necessarily linked to greater comprehension.

About one-fourth of deep-level questions (23%) were directly answered in the text, and these types of questions were not associated with text comprehension. In fact, asking any kind of question that was directly answered in the text indicated a lack of understanding. When readers ask these types of questions, it may be a marker for teachers to intervene. Teachers may wish to prompt the students to locate where in the text they can find the answers as well to self-explain the answers or explain them to each other.

In contrast, more than half of the deep-level questions (56%) that students asked were *not* answered in the text, and these sorts of questions *were* linked to better comprehension. That

lower-performing readers engaged in the kind of thinking that led to such questions is highly encouraging, and it suggests points of leverage for educators. Teachers may want to reinforce and promote this sort of question asking, having small groups of students work together to find the answers to such questions or to develop hypotheses around them.

A second surprise in the data that may help us elucidate the experience of struggling readers is the finding that intrinsic motivation—measured as text interest, curiosity, involvement and preference for challenge—was *not* associated with higher-quality question asking or greater text comprehension. Indeed, for these low-achieving readers, high text interest may have even impeded comprehension by fostering over-confidence and inaccurate judgments of understanding. Because they were interested in the content, these students may have just assumed they understood it and may not have invested the effort necessary to really grasp the meaning.

Bringing teachers to an awareness of this non-intuitive relationship between interest and understanding may help them plan better for such students. For example, rather than employing techniques that primarily build students' interest, teachers may want to intersperse high-interest reading activities with questions and exercises that provoke students to challenge the assumptions they are bringing to the content. Peer questioning and explaining may be one such exercise.

Theory-building about Reading Comprehension and Reasoning

This research provides evidence that, among adolescents, peers can influence not only general academic behaviors such as homework completion, but also finely focused ones such as the effective use of comprehension strategies. In this case, students in the Peer Modeling condition asked higher-quality questions than those in the Control group. Interestingly, the effects of peer modeling on strategy use did not appear to be facilitated by motivational factors.

In other words, it did not seem to be the case that students in the experimental groups asked better questions because they were more interested and curious about the text content. If anything, the models' questions seemed to have prompted readers to pay more attention to the words in and meaning of the text. In turn, this deeper engagement may lead students to ask better questions and to understand the text more deeply.

Further study is needed to determine the ways in which peer modeling exerts its influence on adolescents' specific reading behaviors and comprehension. However, with such information, educators could leverage the effects of positive peer influence by designing activities such as the one examined in this study. Providing struggling readers with a library of texts accompanied by authentic, thoughtful, easily accessible and asynchronous peer commentary and inquiry might help focus and encourage these readers and improve their literacy skills.

In addition to literacy research, findings from this study have implications for theory-building around questioning. Question asking is considered a hallmark of, if not a requisite for higher order reasoning and thinking. Among research about question asking, it is typical to characterize learners' questions by their type and depth. Results from this study suggest that it might be wise to fine-tune some of the current question coding frameworks. In particular, it may be worthwhile to qualify the system for coding question types as deep, intermediate or shallow so that it includes information on the extent to which such questions are addressed or answered in the learning materials. With this added information, researchers might be better able to use students' questions as tools for diagnosing specific errors in comprehension and as opportunities for intervention as described in the previous section.

Design of Computer-Based Learning Environments

In developing systems to support reading comprehension and deeper-level science reasoning, designers may wish to consider using human models rather than relying entirely on animated pedagogical agents. While real children ask less predictable questions than programmed agents, the authenticity, intention and expression (non-verbal and verbal) of their questions may provide learners with a more impactful experience on many levels. Simultaneously addressing multiple channels of learning (social, motivational, and cognitive) may be an effective way to enhance learning and understanding.

Directions for Future Research

This study has raised more questions than it has answered. Fortunately, some of these questions suggest fertile ground for future inquiry. Among these questions are:

- For lower-performing adolescent readers, what is the role of high interest and curiosity in text comprehension? Are there points at which such states of mind reduce comprehension by distracting learners or improperly cueing them about their own levels of understanding? If so, what are these points and how can they be circumnavigated or leveraged for greater awareness and instruction?
- Are certain types of questions, e.g., goal orientation questions, more prevalent for struggling readers? If so, do these question types signify specific types of knowledge deficits that could be directly addressed by teachers or learning materials?
- What are the mechanisms by which peers influence the more minute processes of academic performance, such as strategy use? What part do shifting social norms play in these effects and are the effects sustainable over time?

This investigation builds upon a solid foundation of research about question asking, reading comprehension, adolescent literacy, and social influences on learning. It is hoped that the findings presented in this dissertation contribute to this commendable body of work and open pathways to greater understanding and better support of struggling adolescent readers.

APPENDIX A: RESEARCH INSTRUMENTS

Reading Pre-Survey

Hello! Thank you for being part of this project!

Please answer each question below. Please answer honestly. There are no right or wrong answers.

1. Write in the ID you were given for this project. _____

2. Are you a... Girl Boy

3. How old are you?

10 years 11 years 12 years 13 years 14 years Other

4. What is your background? (Please check everything that describes you.)

- Asian-American
- Black or African-American
- Caribbean-American
- Hispanic or Latino/a
- Native American or Pacific Islander
- White or European American
- Other: _____

5. How do you feel about reading? (Please select on answer for each statement.)

	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
I think I am a good reader.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know what to do to make sure that I understand what I read for science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reading makes me feel nervous.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoy reading.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am sure that I can understand the texts that I have to read for science.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know that I will do well in reading this year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please rate how often you do each of the following activities:

6. When I am reading about something, I try to relate it to my own experiences.

Almost Always Most of the Time Sometimes Not Much Almost Never

7. When I read, I stop once in a while to go over in my head what I have been reading to see if it is making sense.

Almost Always Most of the Time Sometimes Not Much Almost Never

8. I ask myself questions about what I am reading to help me understand it better.

Almost Always Most of the Time Sometimes Not Much Almost Never

9. When I do not understand something I am reading, I read it again and try to figure it out.

Almost Always Most of the Time Sometimes Not Much Almost Never

10. Here are some statements about reading. Please rate how well each one describes you.

	A Lot Like Me	A Little Like Me	Not Much Like Me	Not at all Like Me
I like it when the questions in books make me think.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have favorite subjects that I like to read about.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I read about hobbies to learn more about them.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to read about new things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I usually learn difficult things by reading.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like hard, challenging books.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I read to learn new information about topics that interest me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If a book is interesting, I don't care how hard it is to read.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If the teacher discusses something interesting, I might read more about it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

=====
Thank You!
 =====

Reading Post-Survey

Project ID	
Gender	<input type="radio"/> Girl <input type="radio"/> Boy
Story Text:	<input type="radio"/> The Octopus <input type="radio"/> Social Parasites
	<input type="radio"/> Vampire Bats <input type="radio"/> Immigration
	<input type="radio"/> Buildings

PART I

Please answer the questions below. There are no right or wrong answers; we just want to hear from YOU!

1. How *sure* are you that you understand the main idea of this text?

(100% means that you are completely sure, 50% means that you are about half-way sure you can do this, and 10% means that you are mostly sure you cannot do this.)

- 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. How hard was this text for you?

- Way too easy A little easy Just about right A little hard Way too hard

3. How interested were you in this text?

- Not at all interested Not very interested A little interested Very interested

4. How much do you agree with each of the following statements? (Mark one answer for each.)

Statement	Disagree A Lot	Disagree A Little	Agree A Little	Agree A Lot
This text bored me to death.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed reading this text.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to learn more about this topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My mind wandered while I was reading this text.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I read this text more carefully because I enjoyed learning about the topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I like to read to learn new things.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. For the next reading activity, would you like a text that is?

- A lot easier A little easier About the same A little harder A lot harder

PART II

Please answer the following questions about the kids you saw while reading.

6. The kids I saw in this activity are like kids I know.

(100% means *Definitely Yes*, 50% means *Maybe*, and 10% means *Definitely Not*.)

- 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. The kids I saw in this activity are like me.

(100% means *Definitely Yes*, 50% means *Maybe*, and 10% means *Definitely Not*.)

- 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. The questions asked by the kids I saw in this activity made me more interested in the story.

- Agree a Lot
 Agree a Little
 Disagree a Little
 Disagree a Lot

9. The questions asked by the kids I saw in this activity helped me understand the story better.

- Agree a Lot
 Agree a Little
 Disagree a Little
 Disagree a Lot

10. The kids I saw/heard in this activity did NOT help me very much.

- Very true
 Kind of true
 Not very true
 Not at all true

11. Did you try to answer any of the questions that were asked by the kids in this activity?

- No
 Yes – But not many of the questions
 Yes – Some of the questions
 Yes – Most of the questions

=====
Thank You! Please raise your hand to begin the next activity.
 =====

Question-Asking Worksheet



Your Smart Questions Worksheet

Project ID: _____

Date: _____

INSTRUCTIONS

1. Please **write as many of your own questions** as you'd like on this Worksheet.
2. Write **one question in each block**.
3. **Check off what type of question** each one is.
4. **Check off whether or not you tried to answer this question** by re-reading the text, connecting information in the text or thinking about possible answers.

Your FIRST Question:

- What type of question? Think & Search I Wonder I'm Confused
- Did you think about the answer to this question? Yes No

Your SECOND Question (if you have another):

- What type of question? Think & Search I Wonder I'm Confused
- Did you think about the answer to this question? Yes No

Your THIRD Question (if you have another):

- What type of question? Think & Search I Wonder I'm Confused
- Did you think about the answer to this question? Yes No

Your FOURTH Question (if you have another):

- What type of question? Think & Search I Wonder I'm Confused
- Did you think about the answer to this question? Yes No

Sample of Structured Oral Interview

Text	Participant ID	Date	# Idea Units	# Critical Ideas
Vampire Bats				/14

1. What did the text say about how the vampire bat looks and flies?

- | | |
|---|---|
| <input type="checkbox"/> very small
<input type="checkbox"/> 3 inches in length
<input type="checkbox"/> wingspread as long as a piece of paper
<input type="checkbox"/> furry wings
<input type="checkbox"/> soft wings
<input type="checkbox"/> razor-sharp teeth
<input type="checkbox"/> pointed ears
<input type="checkbox"/> ugly face | <input type="checkbox"/> bats are blind
<input type="checkbox"/> they fly quietly
<input type="checkbox"/> so they're not heard by prey
<input type="checkbox"/> they use radar to fly
<input type="checkbox"/> bounce high pitched sound
<input type="checkbox"/> off things in front of them
<input type="checkbox"/> listen for echo |
|---|---|

Paraphrase: Y -

2. What did the text say about what and how the vampire bat eats?

- | | |
|---|---|
| <input type="checkbox"/> suck blood (CI)
<input type="checkbox"/> from humans (CI)
<input type="checkbox"/> from animals (CI)
<input type="checkbox"/> blood is the only thing they eat (CI) | <input type="checkbox"/> they only suck a small amount of blood (CI)
<input type="checkbox"/> cannot kill a human (CI)
<input type="checkbox"/> cannot kill a cow or a horse (CI) |
|---|---|

Paraphrase: Y -

3. What was the problem that this story discussed?

- | | |
|--|--|
| <input type="checkbox"/> In South America
<input type="checkbox"/> many cows and horses were dying
<input type="checkbox"/> thousands of farm animals were dying(CI) | <input type="checkbox"/> farmers became angry
<input type="checkbox"/> people blamed the vampire bats |
|--|--|

Paraphrase: Y -

4. How did the vampire bats cause this problem?

- | | |
|--|--|
| <input type="checkbox"/> Bats bit an animal, a dog
<input type="checkbox"/> with rabies
<input type="checkbox"/> rabies is a disease (CI)
<input type="checkbox"/> rabies germs | <input type="checkbox"/> got on the bat's teeth
<input type="checkbox"/> When the bat bit another animal
<input type="checkbox"/> it infected that animal w/ rabies germs
<input type="checkbox"/> Vampire bats spread rabies from one animal to another (CI) |
|--|--|

Paraphrase: Y -

5. Why was it hard to solve this problem? (What about the bats made it hard to solve)

- | | |
|--|--|
| <input type="checkbox"/> people could not shoot the bats (CI)
<input type="checkbox"/> because they were too small (CI)
<input type="checkbox"/> and there were too many of them | <input type="checkbox"/> people could not poison the bats (CI)
<input type="checkbox"/> because that would mean they'd have to poison the farm animals (CI) |
|--|--|

6. How was the problem finally solved?

- | | |
|-------------------------------|--|
| ___ scientists had an idea | ___ that made their blood thicker (CI) |
| ___ they gave cows and horses | ___ when the bats drank the thicker blood (CI) |
| ___ a special shot (CI) | ___ they choked and died (CI) |

Paraphrase: Y -

7. What did you like best about this text? Why? (Why didn't you like it?)**8. Imagine that your class was discussing this text and that your friend came late and didn't have time to read it. Your teacher asked you to quickly explain the text to your friend. What would you tell him/her?**

For the last question, there is no right or wrong answer. We just want to know how you think.

**9. W
hich**

of the following would be the most descriptive title for this text? Please explain.

- Science Saves the Day for Farmers in South America
- Stealth Attack: How Vampire Bats Unknowingly Spread Disease
- Don't Blame the Vampire Bat!
- Vampire Bats: Blood-Suckers of South America

Why:

Researcher's Judgment of Comprehension:

1-Very Poor 2-Poor 3-Medium 4-Good 5-Excellent

Sample SVT Assessment

Sentence Activity: Vampire Bats

Please write your Project ID. _____

Instructions

Now you will see about 15 different sentences in three sets. Please read each sentence. After you have read the sentence, please mark either "Yes" - it means the same thing as a sentence in the text or "No" - it means something different than a sentence in the text.

Set 1

	Yes – Same meaning	No – Different meaning
Vampire bats have teeth like razors and floppy ears.		
Because they can't see, vampire bats and other bats use radar to fly.		
Some of the rabies germs got stuck on the bat's teeth after the bat sucked the blood of the animal with rabies.		
Hundreds of animals were dying from rabies, and the farmers became upset.		
The bats were so fast that it was too hard to shoot them.		

Set 2

	Yes – Same meaning	No – Different meaning
Several years ago, people blamed the vampire bats for killing many horses and cows in South America.		
The bats were spreading rabies to all the animals they bit.		
Vampire bats only eat blood.		
Vampire bats can't kill a human, cow or horse because they poison only a small amount of blood.		
Cows and horses were given a special shot to make their blood thicker.		

Set 3

	Yes – Same meaning	No – Different meaning
Vampire bats are only three inches long.		
Because their wings are smooth, they fly quietly.		
When the bat flew to another bat and bit it, the germs infected the second bat with rabies.		
The vampire bats died from drinking diseased blood.		
Poison wouldn't work either because the farmers would have to poison their own animals in order to poison the bats.		

Thank You!

APPENDIX B: MATERIALS**Sample Note to Parents Introducing the Study****INVITATION TO PARTICIPATE IN COMPUTER-BASED READING PROJECT**

February 2011

Dear Parents/Guardians:

Your child is invited to participate in a special, computer-based reading project at <name of school> this spring.

The purpose of the project is to discover new ways to help children improve their reading comprehension. If your child participates, he or she will:

- Receive a reading list customized for his or her reading level and interests
- Be entered into a raffle to win one of two \$25 gift cards
- Learn a strategy that could improve his or her reading.

To allow your child to participate, **please sign and return the attached Parental Permission form to <name of teacher> by WEDNESDAY, FEBRUARY 16th**

Once you have signed the form, your child will take a computer-based reading test. Then, he or she will attend one 40-minute reading sessions during school.

Thank you!

Sample Recruitment Message for Automated Telephone Calls Made by Schools

To parents of 6th graders:

This marking period, you will find an invitation and permission form in the envelope with your child's progress report. These are for a research project that uses a special computer program to improve children's reading. Students who participate will receive a customized book list at their reading level and a chance to win \$25 gift certificates. If you want your child to participate, remember to RETURN THE SIGNED PERMISSION SLIP TO <name of teacher> BY NEXT WEDNESDAY (FEBRUARY 16th). Thank you.

Experimental Texts

Vampire Bats Text

Are there really such things as vampire bats that suck people's blood? Dracula was a character in a book who was supposed to have been a bat part of the time and an evil man after dark. However, everyone knows that Dracula is a made-up person.

But there really *are* vampire bats in South America. They don't turn into men after dark, but they do live by sucking blood from humans and animals. In fact, blood is the only thing they eat.

The vampire bats of South America have many unique physical features. They are very small—three inches in length. When they stretch their furry wings, their wingspread is only about as long as a piece of paper. Their wings are soft, so they can fly quietly and not be heard by their prey. They have razor-sharp teeth, pointed ears, and an ugly face. Like other bats, they are blind and fly using radar. In other words, they bounce a high-pitched sound off things in front of them and listen for the echo.

Vampire bats can't kill a human, cow or horse because they suck only a small amount of blood. But a few years ago, when many horses and cows in South America were dying, people blamed the vampire bats. This is what *really* happened.

One or more vampire bats bit a dog or other animal that had a disease called rabies. When the bats sucked the animal's blood, some of the germs of the rabies disease got into the bat's teeth. When the bat flew to another animal and bit it, the germs infected the second animal with rabies. So the vampire bats were spreading this horrible disease from one animal to another. Thousands of animals were dying from rabies, and the farmers became angry.

For a long time, no one could think of a way to stop the vampire bats from spreading rabies. People could not shoot the bats because they were too small, and there were too many of them. The bats couldn't be poisoned because the only thing they ate was blood and that would mean poisoning farm animals!

Then some scientists had an idea. They gave cows and horses a special shot that made their blood slightly thicker. When the vampire bats sucked this thicker blood, it choked and killed them. These shots were successful in keeping the number of vampire bats down and in saving the lives of many animals.

John Hancock Tower Text

In 1972, the John Hancock Company—an insurance company—decided to build the tallest building in Boston. This building was called the John Hancock Tower, and it was to stand 60 stories tall.

The building was very unusual. The architect, a Chinese-American man named I.M. Pei, made the building in the shape of a parallelogram. Pei also made all the walls of the building out of mirror glass. This is a special glass that reflects light just as a mirror does. If you look at the building from the outside, you see the reflection of other buildings, the clouds, and the sky. However, if you are inside the building, you can look out through the glass as you normally would.

Pei and his design team used this kind of mirror glass for two reasons. First, they thought it would make the building look unique. Second, this kind of glass saves money on air conditioning in the summer. The sun's rays reflect off the glass and, therefore, don't heat up the inside of the building as much.

When most of the huge pieces of glass had been installed, something terrible began to happen. One by one, the panes of glass began to break. Most of them were broken by strong winds, and the pieces fell down the side of the building and broke or scratched other windows. Each pane of glass cost more than \$700. Every time one broke, workers had to take out the pieces that were left and put in a sheet of plywood.

The John Hancock people realized that the glass over the whole building was not thick and strong enough for the winds of Boston. Nobody could move into the new building until they figured out what kind of glass to use, took out all the old pieces and the plywood, and installed new glass.


In the meantime, the glass kept breaking. On one windy day in the winter of 1973, more than 1,000 panes of glass broke. The police had to close the streets below to keep anyone from being hit by falling glass. Someone had made a terrible mistake about the glass, and changing it would cost the John Hancock Company seven million dollars or more! But when the new glass was finally installed, the building came to be regarded as one of the most beautiful skyscrapers in the world.

Screen Shots of Interactive Strategy Instruction Tutorial

Escape from IDunnoKnow


How to Learn Better by Asking Real Questions

With Expert Help from....



Escaping IDunnoKnow: Step 2

In this project, we'll focus on **3 types of questions** you can ask yourself while reading:




1. Think & Search Questions
2. I Wonder Questions
3. I'm Confused Questions

Escaping IDunnoKnow: Step 2

I'm Confused Questions

are about information in the story that **does not make sense**. Usually it **disagrees** or **conflicts** with something you believe, know or have read before.




Answers to "I'm Confused" questions **cannot** be found in the story. You have to compare the information you read with the information you know and think about the differences. It's also good to ask someone for help with these questions.

Escaping IDunnoKnow: See It

Now, let's look at these **three types of questions in action**.

Please read the paragraph below. Click the green button when you're finished.

Research has shown that many plants form networks, similar to computer networks. Individual plants, like strawberry plants, "chat" with each other through delicate stems that run along the ground called "runners." These connections allow the plants to share information and to warn each other about dangers. For example, if one of the plants is attacked by bugs, it will warn the other members of the network using an internal signal. Then, the other plants will release chemicals to make themselves less appealing to the bugs



Escaping IDunnoKnow: See It

Think & Search: What can a plant do to keep a bug from eating it? It can't run away!

I Wonder: Do plants only communicate about dangerous things? What else do they communicate about?

I'm Confused: How can plants chat with each other if they can't talk? What are their internal signals?

Research has shown that many plants form networks, similar to computer networks. Individual plants, like strawberry plants, "chat" with each other through delicate stems that run along the ground called "runners." These connections allow the plants to share information and to warn each other about dangers. For example, if one of the plants is attacked by bugs, it will warn the other members of the network using an internal signal. Then, the other plants will release chemicals to make themselves less appealing to the bugs.

Escaping IDunnoKnow: Final

Excellent Work!

Please close this window to begin today's story.

Have Fun!
And remember... there are **NO** right or wrong questions. So don't be afraid to **ASK!**

Credits
Characters by **Walter Moers**, illustrator and author: *The 13 1/2 Lives of Captain Bluebear*, *The City of Dreaming Books*; *Rumo & his Miraculous Adventures*; *The Alchemist's Apprentice*

Close

APPENDIX C: CONSENT FORMS

Parental Permission Form



Ph.D. Program in Educational Psychology

The Graduate School and University Center
The City University of New York
365 Fifth Avenue
New York, NY 10016-4309
TEL 212.817.8285 FAX 212.817.1516

PARENTAL PERMISSION TO PARTICIPATE IN RESEARCH

Computer-based reading study

You are being asked permission for your child to participate in a research study being conducted by Kallen Tsikalas, a PhD student in the Department of Educational Psychology at the Graduate Center of the City University of New York (CUNY). Your child was selected as a potential participant because he or she is currently a 6th or 7th grader at a participating school or program.

PURPOSE OF THE STUDY

The purpose of this study is to determine the effectiveness of new, computer-based method for helping children improve their reading skills. The study will help us learn whether kids coaching other kids to ask good questions about a text can help them read better.

PROCEDURES

If you allow your child to participate, he/she will be required to attend five sessions at his/her school, after-school or Saturday-school program. Each session will last about one class period (40 minutes).

During these sessions, your child will be asked to use a special computer-based reading program to read aloud some texts. Students will be audio-taped as they read aloud. They will then answer some questions about they feel about these texts and what they understand from them, and they may be asked to look at examples of questions other kids have asked about these texts. Students will ask their own questions, and they will be audio-taped as they do so. Finally, students will be asked to take a reading comprehension test before the project starts. This test will help us know the right level of texts to give children in the reading program—ones that are not too hard or too easy.

POTENTIAL RISKS AND DISCOMFORTS

There are no physical or psychological risks involved for participants in the study. If your child feels uncomfortable or wishes to stop, he or she may quit the study without penalty.

POTENTIAL BENEFITS

Students who participate in this research will be exposed to interesting stories and may learn a method to help themselves read better. They may also improve their reading comprehension and learn that any text (regardless of its subject area) can be made interesting by the ways they choose to engage with it.

PAYMENT FOR PARTICIPATION

All students who return their signed Parental Permission Forms will be entered into a raffle to win a \$25 gift card. Chances of winning are about 1 in 100. Your child does *not* have to participate in the research to enter the raffle; he or she only has to return this signed Parental Permission Form. On the form, you may check "No" if you do not wish your child to participate in the research project.

<http://www.gc.cuny.edu>

THE GRADUATE CENTER IS NY

The Graduate School and University Center is The City University of New York's doctorate-granting institution, which operates in consortium with all the CUNY campuses: Baruch College • Borough of Manhattan Community College • Bronx Community College • Brooklyn College • City College • The Scottie Davis School of Biomedical Education • City University School of Law at Queens College • The Graduate School of Journalism • Hostos Community College • Hunter College • John Jay College of Criminal Justice • Kingsborough Community College • LaGuardia Community College • Lehman College • Medgar Evers College • New York City College of Technology • Queens College • Queensborough Community College • College of Staten Island • York College

CONFIDENTIALITY

Your child will not be mentioned by name in any reports or presentations about the research. Instead, he or she will be given an ID number that will be used to keep track of the information that he/she provides. Your child will provide this information (for examples, answers to questions about the reading assignments) through a secure, password-protected website, and no one will have access to this data except for me and other researchers who are helping me with the project. If you would like a copy of the results of the study, please provide your address and I will send you a copy.

PARTICIPATION AND WITHDRAWAL

Your child's participation in this research is VOLUNTARY. His/her decision to participate or not will not affect his/her grades, schoolwork or relationship with anyone at school. Your child may withdraw from the study at any time with no negative consequences.

QUESTIONS

If you have any questions about this research, please feel free to contact me at (212) 852-6583 or ktsikalas@gmail.com or to contact my advisor, Dr. Barry Zimmerman, at (212) 817-8291 or bjzimmerman@gc.cuny.edu. If you have questions about your child's rights as a participant in this study, you may contact Kay Powell, IRB Administrator, at the CUNY Graduate Center at (212) 817-7525.

Thank you! I will give you a copy of this form for your records.

SIGNATURE OF PARENT/GUARDIAN

Please mark Yes or No.

Yes.

My signature indicates that I have read and understand the information provided above, and that :

- **I AGREE to allow my child/ward to participate in this research study.**
- **I ALLOW my child to be audio-taped reading aloud and asking questions about the text.**

No.

My signature indicates that I have read and understand the information provided above, and that I do NOT AGREE to allow my child/ ward to participate in this research study.

Name of child/ward

Name of parent/guardian

Signature of parent/guardian

Date

Signature of Investigator

Date



Student Assent Form



Ph.D. Program in Educational Psychology



The Graduate School and University Center
The City University of New York
365 Fifth Avenue
New York, NY 10016-4309
TEL 212.817.8285 FAX 212.817.1516

STUDENT ASSENT TO PARTICIPATE IN RESEARCH

Computer-based reading study

My name is Kallen Tsikalas. I am a doctoral student from the Department of Educational Psychology at the Graduate Center of the City University of New York (CUNY). I am asking you to be part of a research project. You were chosen because you are a 6th or 7th grader and your school or after-school program is participating.

Purpose of the research project: The purpose of this research is to find out whether learning to ask good questions about a text can help kids improve their reading skills.

What you will be asked to do: If you agree to be in the project, you will be asked to use a special Internet-based reading program, to read aloud some texts and to answer questions about how you feel and what you understand. You may be asked to look at examples of questions other kids have asked about these texts and to ask your own questions. Finally, you will also be asked to take a reading comprehension test before the project starts. This test will help us know the right level of texts to give you in the reading program—ones that are not too hard or too easy. These activities will happen during five sessions at your school or after-school program. Each session will last about 40 minutes.

How you might feel about the study: You will probably enjoy the activity and find the texts interesting. You may also feel frustrated sometimes. If you feel upset and decide that you do not want to be involved, you can quit the study at any time.

Who decides if you can take part in the study: We will ask your parents to sign a permission form saying that you can be part of this study. But even if your parents say “yes,” you can still decide not to do this. If you don’t want to be in this study, you don’t have to participate. This study is not related to your class work or grades.

If you want to quit the study: You may quit the study at any time without any problems. No one will be upset if you change your mind and decide you want to stop.

Compensation: All students who return their signed Parental Permission Forms will be entered into a raffle to win a \$25 gift card. Chances of winning are about 1 in 100. The odds of winning this raffle are about 1 in 100. You do *not* have to participate in the research to enter the raffle; you only have to return your signed Parental Permission Form.

If I have questions about the study: If you have any questions about the study, you can call me (Kallen Tsikalas) at (212) 852-6583.

If I want to take part in the study: If you want to be part of this study, please sign your name below. You and your parents will be given a copy of this form after you have signed it.

Student's Name

Student's Signature

Date

<http://www.gc.cuny.edu>

The Graduate School and University Center is The City University of New York's doctorate-granting institution, which operates in consortium with all the CUNY campuses: Baruch College • Borough of Manhattan Community College • Bronx Community College • Brooklyn College • City College • The Sophie Davis School of Biomedical Education • City University School of Law at Caspary College • The Graduate School of Journalism • Hostos Community College • Hunter College • John Jay College of Criminal Justice • Kingsborough Community College • LaGuardia Community College • Lehman College • Medgar Evers College • New York City College of Technology • Queens College • Queensborough Community College • College of Staten Island • York College

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